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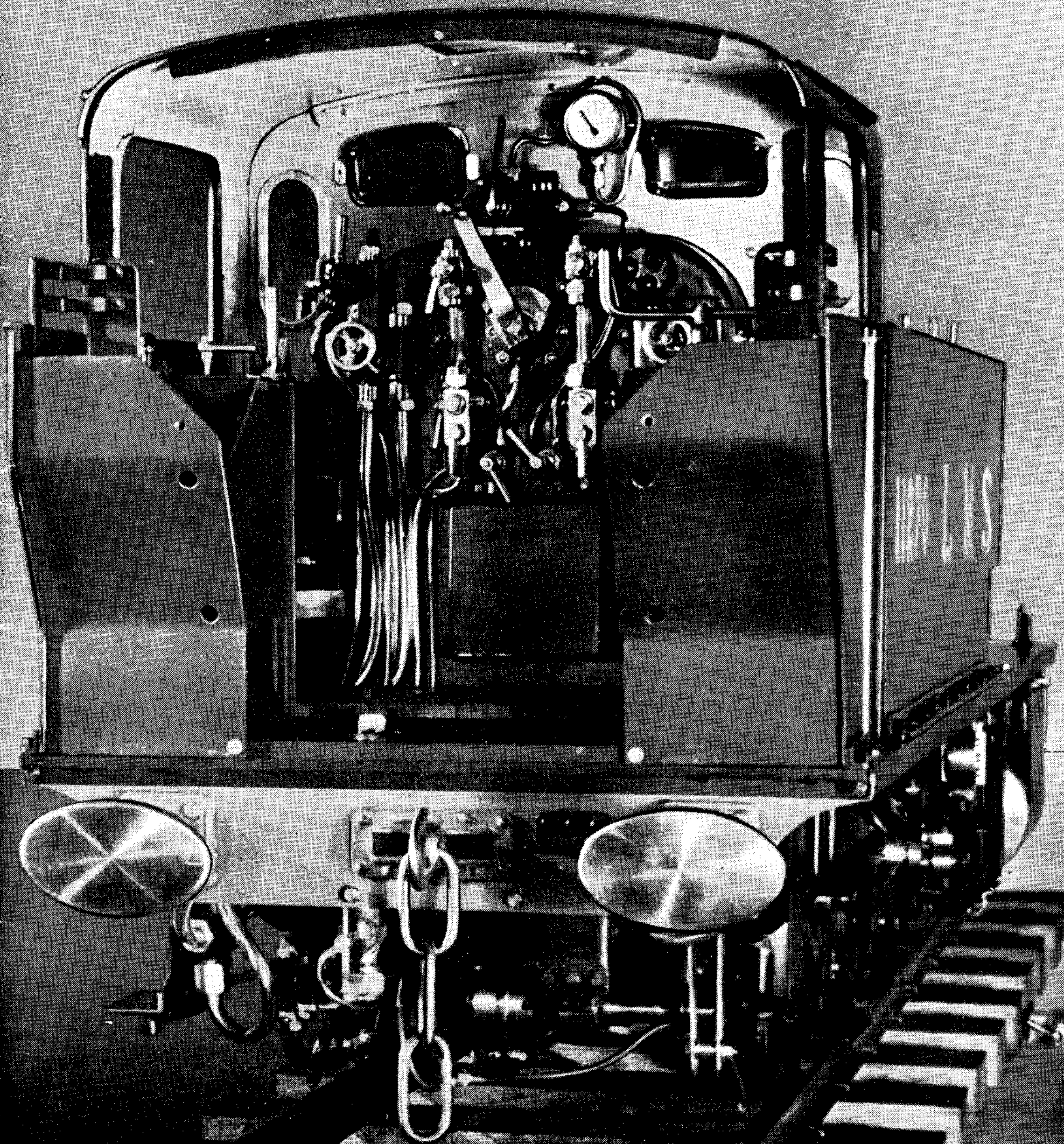
THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

20TH NOVEMBER 1952 VOL. 107 NO. 2687

SMOKE RINGS

Our Cover Picture

● THE PHOTOGRAPH reproduced on our cover this week depicts the cab fittings in Mr. J. I. Austen-Walton's own example of his "Twin Sister" Major. The arrangement and general effect of these fittings set a standard that is not easy to attain but is well worth the attempt. The neat run of piping is one of the features that should not be overlooked, as it produces a most pleasing effect. The fittings themselves are all as near to scale as possible, in view of the fact that they are all working models. Other builders, to ensure similar results, should follow the instructions given by Mr. Austen-Walton rather than attempt any "original" methods.

Incidentally, some misunderstanding seems to have arisen over a rumour that the "Twin Sisters" articles are to be discontinued in December, and we take this opportunity of stating that this rumour is incorrect. The series will continue to its normal conclusion.

The Club Team Cup Winner

● THE BIRMINGHAM Ship Model Society has again distinguished itself in the "M.E." Exhibition. With its three entries, it gained the highest possible number of marks, winning the Championship Cup (seven marks), the Maze Cup (six marks) and a silver medal (five marks). The society won the Club Team Cup—which, incidentally, is open to the model engineering societies as well—for the fourth year in succession, and the Maltby trophy for ship model societies for the second year in succession. This is a magnificent effort, and we tender our heartiest congratulations to the society on its success.

The question now arises, what are the other societies going to do about it? They have no need to be despondent, for some of them, notably N.W. London and Sheffield, were running them rather closely for the Maltby trophy. It should be remembered that the Championship Cup is only two points above a silver medal, and a special cup, such as the Maze Cup and the Willis Cup, is only one point above; also, that a number of diploma models can outweigh a cup-winning model. For the Maltby trophy the amount of work sent in by a society might decide the winner. It remains to be seen whether Birmingham can continue to send in three top-ranking models year after year. We are expecting some interesting competition among the societies for next year's award.

Rowing in the Tank

● ONE OF the most attractive items which performed at intervals in the demonstration tank at the recent "M.E." Exhibition was a miniature racing four; each little figure manned two oars, and together they rowed their boat over the water in a most realistic manner. They created great interest and much amusement, but we felt that pleasurable excitement could be added by another model of the same kind, so that they could race each other. We anticipate that we shall one day see a pair of eights staging a miniature "Boat Race," if only to emulate the popular "Grand Prix" miniature cars!

Exhibition Retrospect

● NOW THAT the 1952 "M.E." Exhibition has come and gone, there is much interest to be gained from looking back on it and recording some impressions that came to us during the run of the show. Perhaps the most formidable task, after the preparations had been completed and the opening ceremony successfully accomplished, was the judging of the Competition section. Seldom, if ever before, have our judges been presented with such an array of really first-class work in all the various classes. This was especially apparent in the Ship section, closely followed by Class L for mechanically-propelled road vehicles (including tractors); in both, the craftsmanship displayed in the woodwork and the machinework was of a very high order, and, of necessity, the judges had to be almost brutally ruthless. All the same, an astonishing number of awards were made.

More than usual, the judges' decisions aroused argument and discussion, but we are satisfied that all the awards were made as fairly as possible, having regard to all the circumstances and all the information available, and we have no reason to question them. Taking everything into consideration, there can be little doubt that the awards, this year, carry more weight than usual; certainly, the judging was never done with greater care.

The return of the passenger-carrying track was warmly welcomed by a very large number of visitors, most of whom seemed to find it more attractive than the miniature car racing track. The latter, however, is a comparatively new venture, with certain teething troubles to overcome, and it is sure to get better and better as time goes on. Meanwhile, it certainly acted like a powerful magnet on the crowds!

The later date was another feature that won much approbation, and we should not be surprised if it has come to stay.

We think that the few rather disgruntled visitors who wanted to know what electronic organs and violin making had to do with model engineering must, eventually, have seen more than enough to give a convincing reply to the question. We have stated, more than once, that the outlook on our hobby is broadening to cover most kinds of pure craftsmanship; the "unusual" exhibits and demonstrations at the exhibition gave practical proof of our statement, and we welcome them on that account.

Something out of the Ordinary

● THERE ARE probably some of our readers who grow and cure their own tobacco; one such is Mr. C. C. Allison, of Pinner, Middlesex, who has also made himself the shredding machine described and illustrated elsewhere in this issue.

Mr. Allison has been good enough to send us a sample of the tobacco that he has grown and cured, and subsequently shredded in the machine; we tried it in our editorial pipe—so essential for composing our "Smoke Rings"—and we find it cool and satisfying to smoke. It has a somewhat cigar-like taste and aroma that are pleasant and certainly add an air of distinction to the editorial office, and that cannot always be said of some of the tobacco-smoke that invades our sanctum! Even our chain-smoking, hand-making cigarette colleague found Mr. Allison's tobacco quite enjoyable and pliable to his nimble fingers.

Birmingham S.M.E. Exhibition, 1953

● THE BIRMINGHAM Society of Model Engineers are arranging to hold an exhibition in the Bingley Hall Annexe between May 4th and 9th, 1953. This is not an annual event, but it is hoped that it will be one of the largest exhibitions held outside the London area. It is expected to have approximately 150 ft. of track for passenger-hauling in $3\frac{1}{2}$-in. and 5-in. gauges.

Although it is anticipated that trades and suppliers of model engineers' requisites will be well represented, the whole of the main body of the hall will be devoted to the display of the model engineers' art.

The traditional request will be made to neighbouring societies for the loan of exhibits, and it is desired to extend to the many "lone hands" who reside in the Midlands, the opportunity of showing their work in this exhibition. A special word to these "lone hands"—although this society would welcome you as members, it is appreciated that some of you may prefer to remain on your own, and, therefore, you are under no obligation whatever in taking advantage of this opportunity.

All enquiries will be welcomed by the society's Exhibition Management, 254, Reddings Lane, Birmingham, 28.

Mr. Amos Barber

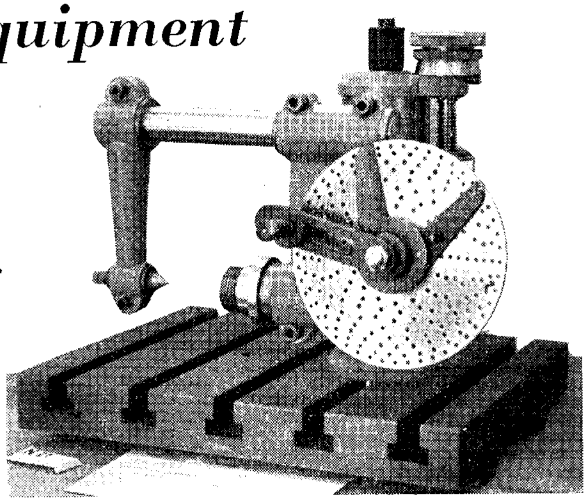
● THE CITY of Bradford Society of Model and Experimental Engineers has recently lost its founder and best-known member by the death of Mr. Amos Barber. It was in 1908 that the society was founded by Mr. Barber, at a time when the organising and running of model engineering societies was far more difficult than it is now; but Mr. Barber's leadership, vigour and infectious enthusiasm won the hearts of everybody associated with him, with the result that the society prospered and never looked back.

As a model maker, Mr. Barber was one of the super-craftsmen; nothing but the best would satisfy him. At the same time, he was a keen but kindly critic, which resulted in his services as a judge being much in demand, and we had the pleasure of being associated with him in this capacity more than once; whenever his unfailing eye noticed promising work on the part of a less capable worker, he never withheld any helpful advice and encouragement. His own work was achieved with the most modest of equipment; yet he seldom produced anything that was not an inspiration to us all. Those of us who examined his models always found in them something to learn as well as to admire. His last model, a mill engine with Corliss valve-gear, which was illustrated and described by "Northerner" in our issue for July 17th last, proves that he retained his unfailing skill to the end, in spite of his 77 years of age.

We associate ourselves with the City of Bradford S.M.E. in mourning the loss of a truly great model engineer and a good friend.

Tools and Equipment at the "M.E." Exhibition

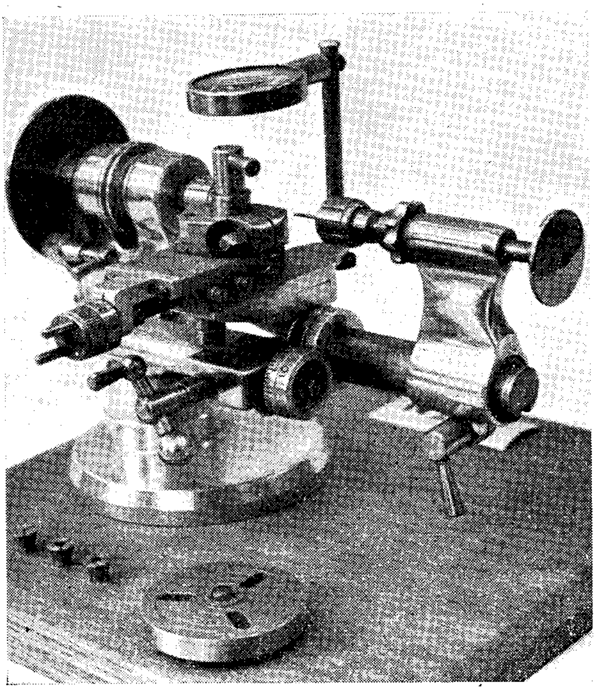
by Edgar T. Westbury



An example of the Turpin universal dividing head by Mr. A. N. Barker

THE importance of tools to all sorts and conditions of craftsmen is always reflected in the display to be seen at the "M.E." Exhibition, and this year, so far from being an exception to the rule, may be counted as one of the vintage years in this respect. Both in the Competition Section and in the trade exhibits, there was evidence of many new developments in the design of hand and machine tools. It is clear that the amateur craftsman now demands a high standard of quality, not only of the tools he buys but also those constructed in his own workshop. Most of the crude devices and makeshifts of the past are superseded, or at least are dying a lingering death, and while the emphasis is still on relatively simple and readily adaptable equipment, the sacrifice of robustness or accuracy to attain these ends is no longer tolerated.

It should not, however, be thought that the development of equipment for the amateur workshop has now arrived at Utopian perfection, or that toolmakers, either amateur or professional, are in a position to rest on their laurels. We still have with us the "good ship spoiled for a ha'porth o' tar," not to mention the misguided ingenuity which produces tools and machines of fearful complexity but dubious practical value. Refinements are often given consideration before essential features, and where the commercial product is concerned, this tendency is often the fault of the customer who demands "frills" and elaboration without being able or willing to pay for them.



Mr. L. R. E. Beale's watchmakers' lathe

In this review of the tools and equipment at the "M.E." Exhibition, I have taken up a critical attitude, because I believe that the time has come for frank and constructive discussion, not only of the virtues, but also the faults and limitations of these exhibits. Some otherwise excellent examples were marred by obvious faults in minor details, or in the fit and finish of working parts. The polishing mop and the abrasive strip were too readily applied to working parts in many cases, while non-working parts which would have been much better painted were glamorised by quite unnecessary surface finish. Some constructors were inclined to overwork the ubiquitous socket-head screw, which despite its strength and neatness, is not always

the best or most convenient form of fixing on a machine tool or attachment.

Competition Section

The most notable feature here was the revival of interest in dividing appliances for the lathe, no less than six of these devices being entered, three of which were of the type recently described in detail by Mr. A. R. Turpin, with or without detail modifications. In one of these, made by Mr. W. D. Urwick, of Taplow, a patented form of guide key of triangular section was fitted to the head, working in an offset vee groove in the vertical column, thus providing facility for taking up any rotational play which may develop in the course of wear. The graduated handwheel of the vertical feed screw was fitted with two projecting pins, to facilitate operation; but while this is not an uncommon arrangement, and highly practical, its appearance was impaired by making the pins plain and parallel, instead of elegantly curved.

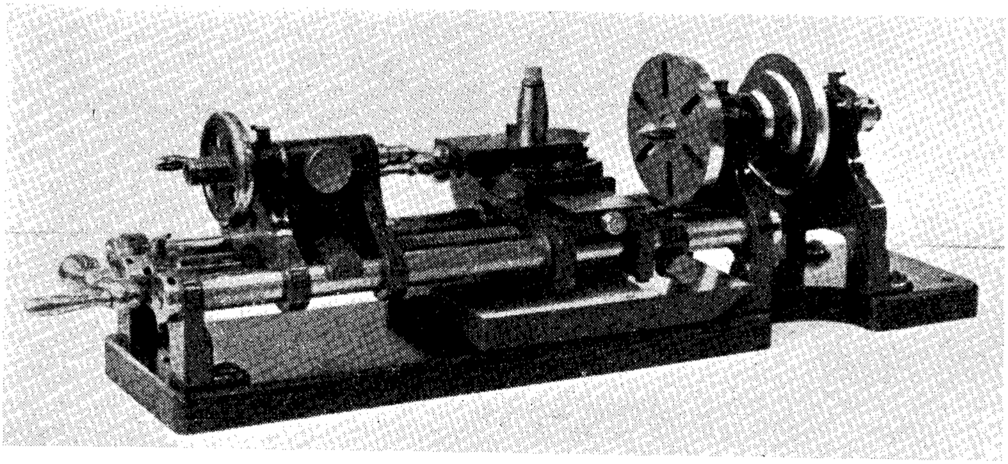
The other two dividing heads of this type were entered by Messrs. J. W. Burgess, of Edinburgh, and A. N. Barker, of London, N.11, and were well made, with the exception of one or two errors which emerged on close inspection. It is rather interesting to note that even in items made ostensibly to the same drawings, the individuality of the constructor shows up in details of fit and finish.

In the "Utility" dividing head by Mr. B. Bull, of Welling, the principle of employing lathe change wheels as division plates was adopted, incorporating a "vernier" or differential indexing device, to increase the range of divisions obtainable. This method is quite well known, but an ingenious improvement was the addition of counter mechanisms, to facilitate the task of keeping track of the complicated permutations which are possible when differential dividing is employed.

The miniature dividing head by Mr. L. R. E. Beale, of London, N.W.3, was of more or less standard design, with the usual worm gearing, presumably made to fit a lathe of about 2½ in. centres, and quite well made.

The same exhibitor showed a very neat and ingenious watchmaker's lathe with a cylindrical bar bed, the headstock and other structural castings being home-made from aluminium alloy. The use of this material for certain parts of machine tools is not without precedent, but the high polish on these castings was rather out of character, and they would have looked much better enamelled in black or grey, in keeping with usual practice on such machines.

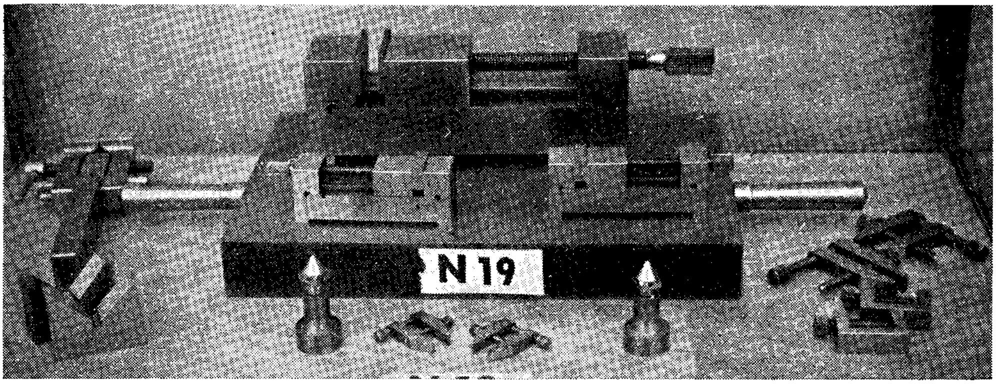
Other home-made lathes entered in the Competition Section included a well made 2½-in. precision type lathe by Mr. S. R. Harris, of Morden, a 1½ in. back-geared screwcutting lathe by Mr. H. M. Hayes, of Worthing, which in many ways resembled a scale model of a much larger machine, and a miniature twin-bar-bed lathe by Mr. D. Kydd, of Gloucester.



A twin-bar-bed lathe by Mr. D. Kydd

Drilling machines were not so well represented in this section as they have been in some previous years, but the specimens shown were not without interest. Mr. G. T. East, of Tolworth, entered a very neat motorised drill of fabricated construction, for drills up to ⅛ in. This was equipped with the orthodox quill bearing and rack feed, an interesting feature being a circular window in the front of the quill housing, through which a depth scale on the quill could be seen; but though enhancing appearance, this was not so easy to read as the more usual external scale.

The exhibit of ten drilling machines by the Redditch and District Model Engineering Society was an unusual and rather spectacular one. The design of the machines, however, is open to some criticism, and embodied what appeared to be incongruous features. It was noted that the spindle bearing housings had split lugs with clamping bolts, presumably intended for the purposes of taking up wear; but the saw cut was not continued right through into the bore, and this purpose, therefore, could not be achieved.



A collection of small tools by Mr. E. V. Elderkin

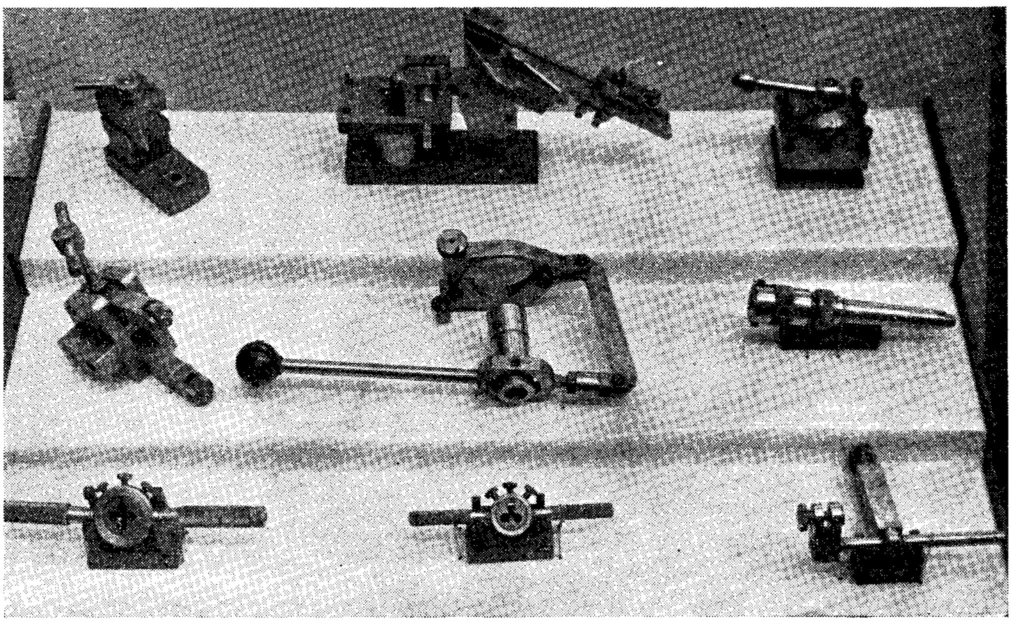
(Incidentally, it may be observed that adjustable spindle bearings are hardly necessary for small drilling machines if the spindles are properly fitted in the first place.)

The table supporting arms were also equipped with split lugs for clamping on the main pillar and the stalk of the table, and in all cases the clamping bolts were located too far from the bores to give a really effective grip without risk of straining the lugs. With all forms of split clamps, it is desirable to locate the bolts only just clear of the bores, and the lugs should be stiff enough to avoid risk of distortion when the bolts are tightened.

A further error in design is that the pulleys have round-bottomed grooves, so that the belt would lie on the bottom, instead of gripping the angular sides and getting the advantage of the wedging effect. All *driving* pulleys for round or vee belt should provide clearance in the base of the groove, but *jockey* pulleys which serve only as guides, and do not transmit power, may have round or flat-bottomed grooves.

The jockey pulleys of these machines were fitted to a horizontal bar with lateral and swinging adjustment, but no means were provided for aligning the pulleys with the steps of the spindle pulley. Balance weights were fitted to the feed levers for returning the spindles ; this arrangement is often preferred to the use of return springs, but it is difficult to arrange really neatly, and the particular method adopted was not very satisfactory in this respect.

In case this criticism may appear harsh, let it



A group of tools and attachments by Bernard Lyons

be understood that its purpose is not so much condemnatory of a particular exhibit, as to advise and assist future designers.

A very ambitious undertaking in this section was the machine by Mr. G. D. Reynolds, of Farnborough, described as a "combined jig borer and vertical milling machine." While this is quite ingenious in design, and well executed, one may wonder whether it quite comes up to the extremely high standard of accuracy and rigidity demanded of the modern jig borer. It would certainly be a very useful machine for innumerable purposes in the home workshop, but its capacity is severely limited, and the twin-bar vertical slide would appear to be liable to deflection. Among the good features of the design may be counted the protection of the slides by spring roller blinds and the self-contained quill bearing, with enclosed bevel gear drive from a horizontal shaft with stepped pulley at the back of the machine. The quill has a limited vertical feed movement by means of a lever, and this is equipped with a return spring.

Two very ingenious attachments for a "Pool" milling machine were shown by Mr. A. E. Bowyer-Lowe, of Letchworth. The first of these was a vertical milling attachment, incorporating a spindle driven by bevel gearing of 1 : 1 ratio, enclosed in a headstock with a circular base, with swivelling adjustment. The driving shaft is tapered to fit the socket of the main spindle and arranged to be secured with a draw bolt. While the general design of this attachment follows standard practice, its details are ingenious and highly practical. The second exhibit was a slotting attachment, having a vertical slide operated by means of a connecting-rod from a crank driven from the main spindle as in the previous case. A very ingenious method of providing a variable stroke to the slotting tool is provided, by superimposing an eccentric on the driving crank. This is driven from the latter by multiple splines, and by adjusting the relative phase of the two components it is possible to vary the slide travel from zero to twice the combined throw radius. The head carrying the slide is also capable of swivelling adjustment so that angular slotting can be carried out.

The collection of small tools by E. V. Elderkin, of Ruislip, appeared to have the earmarks of the professional toolmaker. Their workmanship and finish were extremely good, and there is little doubt of their practical utility, but their design, obviously related to the method of production, is in some cases open to criticism. In many classes of toolmaking, particularly gauges, it is the usual practice to drill holes in the corners, to facilitate the production of straight surfaces, and avoid "riding" of mating components. This practice, however, is ill applied to the design of a vice or clamp, which may be seriously weakened by undercutting the corners ; as could be seen at a glance at certain items in this group, and constituted a fatal fault in an otherwise irreproachable exhibit.

In the Junior Section, the group of tools by Bernard Lyons, of Hove, deserves special mention as a praiseworthy effort for such a young competitor. It included several items which have been described in THE MODEL ENGINEER by "Duplex," and the workmanship in all cases was better than that of many exhibits by competitors of more mature age.

Other exhibits in this section included a "Cowell" shaping machine by A. and A. R. Kidd, of Watford, a nicely-made slide-rest and toolpost for a small lathe by M. J. Morant, of Salisbury, a boring head for a $3\frac{1}{2}$-in. lathe by W. H. Rider, of Wembley, an adjustable back centre by E. Jones, of Llanidloes, and a "Duplex" twist drill grinding jig by R. S. Shute, of Chippenham.

(*To be continued*)

The Small Scale Railway Models

by G. M. J. Chesmore

TAKING the Competition Section of the exhibition as a whole, the "B" and "C" classes (covering railway locomotives, rolling stock and accessories of $1\frac{3}{4}$-in. gauge and under) contributed only a small number of exhibits—in this particular case twelve in each class—and I wonder why it is that the many thousands of English model railway enthusiasts should be so unwilling to show their achievements to the public ; this type of model is, after all, easily transportable, compared with a 5-in. or $3\frac{1}{2}$-in. gauge locomotive !

My immediate impression after a quick look round, was that about ninety per cent. of the competitors do not realise the importance of careful paintwork and insignia. All but about three models could have been improved, some of them out of all recognition, by more attention to the work of the "paintshop." It seems such a pity that someone should cover up all his careful constructional work with house paint or ruin the symmetry of a cab or tender side by disregarding the size, style and spacing of the prototype numbering and lettering. There is no doubt that the painting of models is an art—a most difficult art—but one that is well worth mastering. It is true that many flaws in construction can be disguised with artful brushwork, but it is equally true to say that a perfect example of metalwork can be spoiled by an inexperienced painter.

Of course, all this has been said before, but it is apparent that it needs to be said again, and I do urge all modellers to take the greatest care in this question of painting ; and if you really think you cannot make a good job of it yourself, then have it done by a professional model maker. This will naturally incur some additional expense, but it is an outlay you will never regret.

Perhaps the most striking exception to my foregoing remarks about poor painting was the 4 mm. scale Midland Railway 4-2-2 locomotive *Princess of Wales* entered by Mr. R. J. B. King of Strood, Kent. This was a little gem which shone and sparkled back at me as I looked at it, and it is about the only locomotive to my knowledge having a really high gloss varnish which does not look gummy.

I suppose it might be said that the finish was too glossy to be realistic ; but we must remember that the Midland Railway in particular turned out its locomotives and rolling stock with an exceptionally high finish. If I remember rightly, the total number of primers, undercoats, colours and varnishes on each vehicle amounted to something like 14 layers.

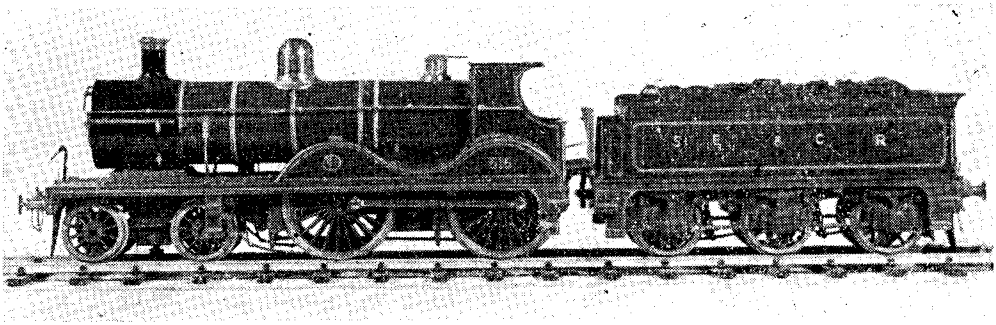
The only thing which displeased me was that the tender bogies were not quite far enough forward in relation to the body, giving slightly too much emphasis to the overhang at the footplate end.

Notice that this model was lettered with hand painted transfers and the main surfaces were brush painted ; so you see, it is not essential to possess costly spray equipment to produce a high-class finish, as some people would infer. I was glad to see that the judges awarded a Bronze medal and the *Model Railway News* first prize to Mr. King for his fine work. Although *Princess of Wales* was the only locomotive entered in the competition by Mr. King, it was shown in a glass case, in company with four other pre-grouping models by the same competitor, all of a high standard, constructionally and pictorially. All of the models have 12 volt, 7 pole armature, ball-bearing motors coupled to flywheels, so I imagine their performance matches their appearance.

Mr. G. E. Bush of London S.E.6 exhibited a working model Emett " Festival " engine, tender and coach based upon the trains used at the Battersea Park Fun Fair and as such was an amusing exhibit of the kind always popular with the general public. But, of course, it was not really an Emett train at all—and neither is the one in Battersea Park ; that is, if we are to take the artist's cartoons in *Punch* as our guide, which seems logical. Everyone who has attempted to portray an Emett train in three dimensions has made the mistake of producing a working model. I am open to correction by the artist himself, but it seems to me that a *thoroughbred* model of the Saturday Slow to Buffers End just couldn't be made to work. Surely, the whole charm of the cartoons is the utterly fantastic and unworkable mechanics shown ! However, enough of these musings.

Several Great Western locomotives were included in Class " B." Two were in S-gauge (previously Half-One gauge) ; both very creditable first attempts, especially in view of the fact that no commercial parts are manufactured for this scale so that the builder has to make do with modified or built up components. In the case of the 4-4-0 " County " class engine entered by Mr. H. G. Kerr of Stanmore, Middlesex, which received a Highly Commended Diploma, all the wheels were drilled and filed from the solid—a formidable task for the beginner with limited workshop facilities. The engine is designed to run on 24 volts stud contact electrification. The other representative of this rarely used scale came from Mr. G. Tompkins of London, S.W.4, who has made a 1400 class G.W. 0-4-2T. In this case a number of " OO " gauge commercial castings were found suitable for the wheels and axleboxes, thus saving the builder a considerable amount of work.

The " OO " gauge " King " by Mr. R. L. P. Green of Malvern, Worcs., struck me as an attractive job having quite a deal of " King " character about it. Before this remark puzzles you, let me say that, from my observations, the Great Western " Kings " have a character—something in the way they " sit " on the track, if you like—which modellers find elusive ; for there are many model " Kings " in name but not in appearance. And when the display card by the model told me that this was a first attempt, constructed with the help of only a few small hand tools, with all turned parts made in a wheelbrace, I had to admit that here was someone with determination and patience, providing a little object lesson to those potential modellers who have listened to the pessimists and have been discouraged because they do not own a fully equipped workshop. Yet here again was an example of good work spoilt in the final stages, for a glance at the tender revealed that the



4 *mm. scale S.E. & C.R. Class " E " locomotive by Mr. J. L. Hoskins*

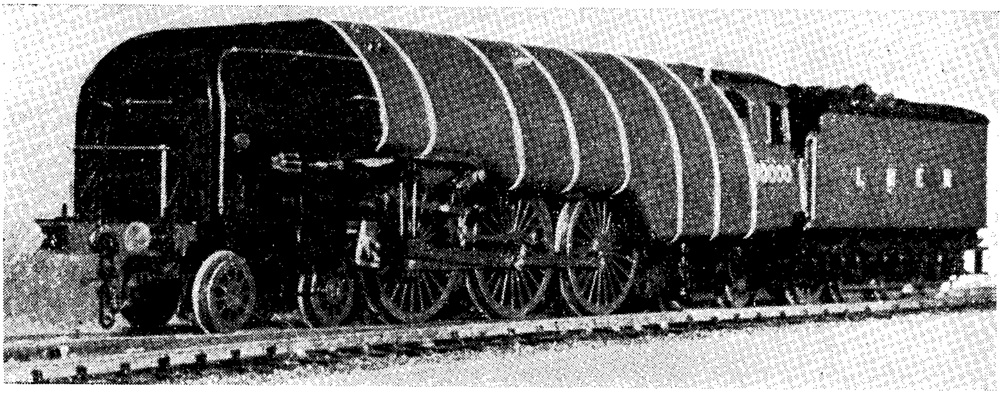
"Great Western" transfer had been affixed just a little out of square; just enough to distract one's eye. Nevertheless, Mr. Green has made a fine effort worthy of the encouragement it received in the awards of a Very Highly Commended Diploma and the *Model Railway News* Third Prize.

The Class "E" 4-4-0 locomotives of the South Eastern & Chatham Railway were very representative of that company's practice and were good engines even if their popularity amongst locomotive enthusiasts did not quite approach that of the "D" class 4-4-0s. Mr. J. L. Hoskins of Par, Cornwall, has made a pleasant 4 mm. scale "E" and I am glad to see that it is "all square." So many models have sloping cab roofs, kinks in running plates and so on, but Mr. Hoskins has managed to avoid this sort of thing completely. He has made a stout effort to reproduce the extremely complicated S.E. & C.R. lining with a fair degree of success, but what a pity more time and attention could not have been given to the company's initials on the tender side. Their present spacing and style leaves room for considerable improvement, and I hope the builder will feel inclined to tackle their revision.

The model is interesting from the mechanical point of view in that the motor is housed in the tender and drives on to the front tender wheels, the locomotive being pushed along by the tender. This method of propulsion is resorted to when insufficient motor space can be found in the locomotive boiler or firebox. Mr. Hoskins was awarded a Highly Commended Diploma.

The last exhibit in Class "B" that I would like to mention is the first model I have seen of the L.N.E.R. high-pressure compound locomotive No. 10000—the "Hush-hush" engine! Nowadays No. 10000 as rebuilt looks much the same as an A4 Pacific but Mr. J. N. P. Rowe of Welwyn, Herts., has modelled her in the original form and the unusual cross-sectional body contour given by the Yarrow-Gresley type of boiler is well reproduced. The valve gear has been nicely made to scale proportions and must have entailed many hours of fine work. The painting generally is good, especially the hand done lettering, but some hurry in picking out the boiler bands has slightly marred the overall picture. The massive and unconventional appearance of the prototype is immediately apparent in this 4 mm. scale version, as the photograph herewith shows, and the judges have recognised Mr. Rowe's work with a Very Highly Commended Diploma.

In Class "C," embracing rolling stock and accessories, were three examples of Southern Region coaching stock, all of which merit our attention. Mr. L. Bramma Smith of London, S.E.27 entered his 7 mm. scale Southern Electric 2 HAL unit which gained a Highly Commended Diploma. The prototype 2 HALs are familiar to me as I travel in them frequently and have often toyed with the idea of modelling a set. Mr. Smith's version pleased me considerably and he, for one, has not forgotten the roof piping and other details common to Southern multiple unit stock. Conversely, there are "wide open spaces" under the frames which should be filled with dummy electrical and brake gear.



4 mm. scale L.N.E.R. experimental locomotive No. 10000 *by Mr. J. N. P. Rowe*

Mr. T. G. Baker of London, S.E.20 provided a Southern Electric steel suburban motor coach, also in 7 mm. scale. This was presented in its correct environment, so to speak, with a short length of track for it to stand upon and a fine model of the Wimbledon Up Home colour-light signals for it to wait at! The body contour of the coach was not quite round enough and the suggestion of the prototype's smooth steel sides would have been conveyed more vividly if a finer and less gritty quality of paint had been used. This exhibitor had successfully applied the correct "purple-brown" dust colour to appropriate surfaces (roof and undergear) and it is worth pointing out that a model coach which is supposed to be in service should have this touch of realism, as the ex-works grey roof and black underframe never last for more than a few days in practice. The undergear was well reproduced and everything was included—resistances, contactors and brake equipment. Mr. Baker secured a Highly Commended Diploma.

The last of the Southern models came from

another modeller in "Southern territory," naturally enough—Mr. D. A. Williams of Beckenham, Kent who submitted a 4 mm. scale three-coach set of Southern post-war flush-sided steam stock coaches, which won a Very Highly Commended Diploma. These are three of the most realistic Southern flush-sided coaches I have ever seen, and they are especially noteworthy in that they have been constructed mainly of card. The owner exhibited, alongside the finished article, his own punch, used to cut out the windows. Using this punch, a coach side with thirty window apertures can be marked out and punched in about ten minutes, and the complete uniformity of the size and shape of the windows illustrated one other advantage of a jig and punch for this type of repetitive work.

There were several other models worthy of discussion but in this space I am unable to deal with them all. Suffice it to say, that my tour of inspection in preparation for this article gave me a good deal of pleasure and I look forward to next year's exhibition with, let us hope, an augmented small scale section, more representative of the model railway hobby as a whole, and with as much care given to the painting of the exhibits as to their construction. Let me end, then, as I began—with the accent on painting. Remember—colour makes all the difference. Where you put it on and how you put it on count more than you may think. Give this all-important process more time when you come to finish your next model. It will be time well spent.

Model Traction Engine Queries and Hints

by "Kent Cob"

AS I wished to construct a 2-in. scale finely-detailed model of a Paxman single traction, and had little experience of so large a scale, I decided that the best policy was to write to THE MODEL ENGINEER.

First, let me say that I do possess a copy of one of Davey' Paxman's fine catalogues, and, secondly, that I have access to the particular prototype, which is not too far away, and from which I have nearly completed an accurate set of drawings.

Perhaps having read the foregoing, you may ask "well, I don't see what he has got to worry about," but read on, brother, and you will soon know. As already stated, I want this model to be above criticism with regard to all the external details, and here I meet my first snag. The catalogue gives the rear wheel width of the 7-n.h.p. engine as 1 ft. 6 in., fair enough, that is 3 in. wide in the model, but one wheel measured 1 ft. 5¼ in. and the other 1 ft. 5½ in. To keep the general appearance of heaviness, which so often spoils such models, at bay, I have decided to use 1 ft. 5 in. wheels, scaling 2 5/6 in. wide. Is this still considered scale, then?

The hornplates, too, offer a bit of a problem in two ways. First, they are just over $\frac{7}{16}$ in. thick. I think I can legitimately call this ½ in., but will the scale equivalent of 1/12 in. be strong enough? On looking through back numbers of THE MODEL ENGINEER for several years, I find that ⅛ in. would appear to be the thinnest used in this size, so what should I do? Secondly, they are 2 ft. 5⅛ in. apart at the front and 2 ft. 5⅝ in. apart at the back. To suit the boiler tube, I suggest adopting 2 ft. 5½ in. scaling 4 11/12 in.

I estimate the model will scale 150 lb., and again this worries me concerning the thickness of the wheel rims. The hind wheel on the prototype is only ⅝ in. thick scaling 5/48 in. in the model. I think I could call this ¾ in. scaling ⅛ in. The front wheel rims are only ½ in. thick scaling 1/12 in., but here again I think 1/10 in. is called for. The catalogue gives the hind wheel diameter as 6 ft., but in actual fact, it is a bare 5 ft. 11½ in. a point I feel inclined to ignore, allowing this discrepancy to be made up by the ⅛ in. rims.

Well, I could continue in this vein for quite a time, but will leave it at that, with the fond hope that some experienced traction modellers of this scale will help me out. Before continuing with a few tips, however. I must ask a few questions. Can anyone let me have detailed drawings of any parts, especially the near axle impedimenta, such as differential gears, winding and brake drums, and of all unseen parts such as cylinder block internals, etc.

I have, however, decided on 13-gauge 4¾ in. diameter solid drawn copper tube for the boiler proper, which is 11 1/6 in. long from tubeplate to tubeplate. I should think eleven tubes $\frac{9}{16}$ in. diameter, outside 20-gauge and one ¾ in. superheater would cover that, using ⅛ in. tubeplates. Finally, the bunker will be made from sheet brass knocked over formers, but how thin can I go?

Now for a few tips for those people who spend days out on "measuring" trips, after any type of engine. I always take the following items.

(1) A camera. I have 30 photographs of the said Paxman, and will need many more.

(2) A steel tape measure. This must be made of metal and preferably over 20 ft. long for tractions.

(3) A pair of large calipers for connecting-rod diameters, etc.

(4) A two-foot steel rule.

(5) A long piece of string with a nut tied at each end. This is hung over the boiler, smokebox or what have you, and by measuring across the two hanging ends the diameter is quickly obtained.

(6) A pair of compasses and scissors. These are used in making circular templates for ascertaining the radius of spoke palms, motion plate flange radii, and the like.

One final word of advice, always make large rough sketches of each part, dimensioning them as you go.

An Infinitely Variable Speed Drive for the Lathe

by J. Latta

WHAT imaginative turner has not desired an infinitely variable change speed for his lathe? The ability to obtain any mandrel speed from the fastest to the slowest, by simply turning a handle, with the lathe still in motion, seems a delightful idea, and opens up great possibilities in the way of easier and faster work; and if the gear can be arranged so as to extend the speed range at both ends, the scope of the lathe is still further increased, as it is rare that the normal cone pulley and back gear cover the very wide requirements of the model engineer.

A No. 60 drill will need all the speed that the mandrel bearings can stand, possibly 1,500 r.p.m. or more; and on the other hand, a 10 in. flywheel casting with hard spots in it, makes you think that 10 r.p.m. is plenty.

Needless to say, no lathe maker attempts to provide such an enormous range of speeds on the lathe itself, and if such extremes are desired, something extra in the way of external gearing must be arranged.

At one time I had a petrol engine to drive my lathe, and the speed could be varied quite a bit by loading the governor spring as required, by means of a handy lever. The want of this convenience was felt immediately a change was made to electric drive, and I began to consider various schemes to get over the difficulty without vast expense.

In recent years a great number of hydraulic, electrical, and mechanical gears of the infinitely variable type have been devised for machine tools, motor vehicles, and other applications, but most of them can be ruled out on the score of complication or cost.

My first experience of such a gear was on a Lang lathe, at which I worked during my apprenticeship days. On this machine, the usual cone pulley was replaced by two large expanding V-belt pulleys, suitably linked together so as to maintain a constant tension on a very wide V-belt, which was built up of wooden slats riveted to a leather backing; the ends of the slats being bevelled so as to drive on the sides of the V-pulleys. This device worked well so long as it was not overloaded, but when the belt slipped, it made a fearful row that could be heard from one end of the shop to the other.

The makers eventually abandoned the device when the power requirements of machine tools became more than the drive could cope with; nevertheless, these lathes were very popular during the first two decades of the present century.

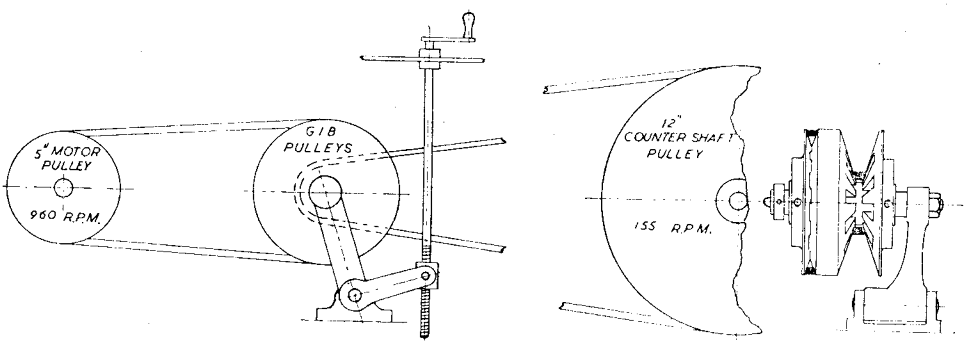


Fig. 1. Low speed

Older motor-cyclists will remember the Zenith Gradua and Rudge Multi gears which worked on a similar principle; they also worked well as long as the belt was dry, but the range of ratio was rather limited, and they were eventually replaced by the present-day gearbox.

The well-known "Little John" lathe has a variable gear of this type, using a specially flexible rubber belt, but as far as I am aware, the device is not available as a separate fitment.

If d.c. current is available, the speed of the driving motor can be varied to quite a considerable extent by a field resistance, but if more than a small speed range is wanted, the motor becomes rather large and expensive if it is to give sufficient power at low speed. Variable speed a.c. motors are made, but are more complicated than the d.c. type, so that a purely electrical speed control hardly seems a proposition for the impecunious amateur.

Recently a number of hydraulic units for the control of aircraft turrets have been available on the surplus market at a very reasonable price, and these could be adapted to drive a small

lathe with considerable success. In a sense they do almost more than is wanted, as the speed can be reduced right down to zero by the control lever, and further movement reverses the drive and gives the full range up to the maximum. Unfortunately, the bulk of the unit made it difficult to accommodate in my case, and the complicated nature of the mechanism, and the probable difficulty in obtaining spares in case of a breakdown, decided me against it in spite of its obvious attractions.

The arrangement as finally schemed out, uses a pair of side-by-side expanding pulleys made by G.I.B. Precision of 17, Stratford Place, London, and after being in use over a period of about eight months, the drive is an unqualified success. The speed of the lathe countershaft can be varied in a 7/1 ratio, although actually the makers state that 6/1 is the maximum. This range easily covers all requirements.

The maximum mandrel speed now available is about 1,600 r.p.m., which is just about as much as the lathe bearings will stand; and, condition now being 83 r.p.m. Although high speeds with the back gear in make for noisy working, a considerable increase of power is available, due to the greater belt speed, and this is useful for heavy cutting.

The arrangement of the drive is shown diagrammatically in Figs. 1 and 2. There are two V-belts; the first between the motor and the GIB expanding pulleys, and the second from the expanding pulleys to the lathe countershaft above.

The expanding pulleys run on a pin fixed to one end of the rocking arm *A*. The other end of this arm is pivoted on a bracket fixed to the lathe bench, so that it can be moved over a short arc, by means of the speed control handle *B* and the screw *C*.

In order that the GIB pulley flanges can close together and allow the belt to run on the larger diameters, they are made with a number of interlocking slots, as shown in the elevation at the right-hand side. The two outer flanges are fixed to a bushed sleeve which runs on the pin.

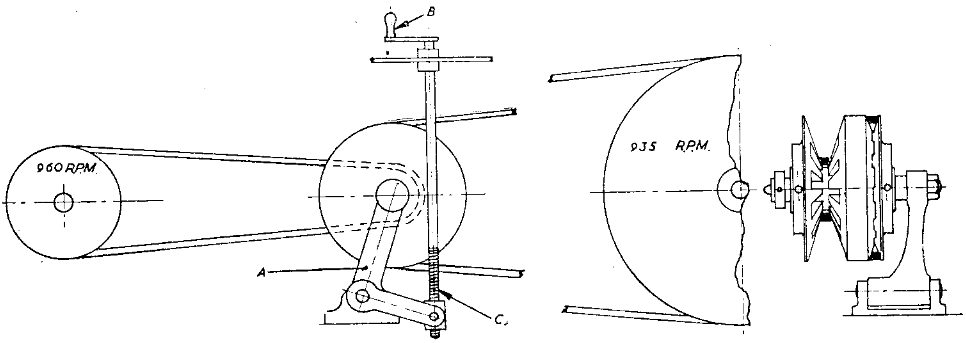


Fig. 2. High speed

incidentally, this speed requires a considerable amount of power, as is shown by the fact that the 1 in. wide leather belt on the cone pulley will not drive unless it is reasonably tight. However, the V-belts on the variable gear show no sign of slip on top speed, and this is as it should be, as no doubt they would wear rapidly if they did.

I chose a set of 6½ in. variable pulleys, which are on the generous side as regards diameter, and no doubt a smaller size would have filled the bill, but I felt that it was wise not to be too economical in this respect.

The back gear of my Milnes lathe gives about a 5/1 reduction, which is not as great as some, but even so, I can now get a minimum mandrel speed of 17 r.p.m. Extremes of speed tend to be hard on the V-belts, as they are then working on the smallest diameters of the pulleys, but actually they are seldom required, and normally the belts work well within their capacity, and should have a long life.

A much-appreciated feature is the way that the capacity of the lathe is now extended without using the back gear, the slowest speed in this

The inner flanges are made in one piece, and can slide along the sleeve within the limits imposed by the outer flanges, from which they are driven by the interlocking slots.

Fig. 1 shows the position of the belts on the low speed. The motor belt drives on to the largest diameter of its variable pulley, while the countershaft belt runs on the smallest effective diameter of about 2½ in., thus driving the 12 in. countershaft pulley at about 155 r.p.m.

By turning the handle *B* so as to bring the rocking arm into the position shown in Fig. 2, the countershaft speed is increased to its maximum of 935 r.p.m., as the diameters on which the belts now run on the GIB pulleys are reversed as shown.

Any intermediate speed can be obtained by positioning the gear accordingly by means of the control handle. Of course, the speed can only be changed while the belts are in motion.

It will be seen also, that the tension of both belts remains unaltered in all positions, or at any rate, not appreciably so. The GIB unit as a whole can float sideways slightly on its pin, so that the two belts can maintain their alignment with the

motor and countershaft pulleys. The tension of both belts can be adjusted by moving the motor, or if this is not convenient, either of the two outer flanges can be moved inwards slightly along the sleeve, to which they are secured by Allen setpins. Such a movement of the flanges, slightly alters the speed variation obtainable, but as this is very ample, it is of little consequence.

I have used ordinary $\frac{1}{2}$ in. standard V-belts, but larger or smaller section belts can be used if desired, by making the appropriate adjustments.

In my own case, the lathe countershaft is supported on an angle-iron framing immediately above the lathe, and 6 ft. 3 in. from the floor level; the motor being placed on a shelf below the bench, with the shaft 16 in. above the floor, the previous drive being by a flat leather belt $1\frac{1}{2}$ in. wide.

Owing to the construction of the bench, the space available for the gear was somewhat limited, and it needed some contriving to find room for everything; even so, a fairly large cavity had to

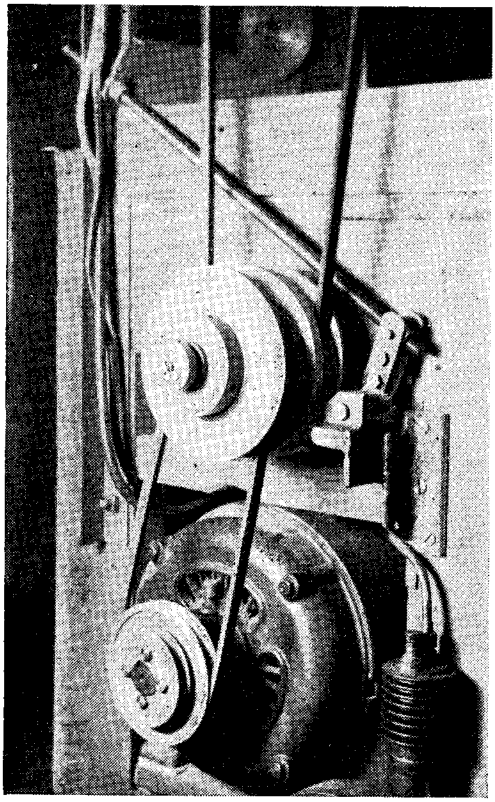


Fig. 3. Infinitely variable gear mounted on the end of the lathe bench

be hacked out of one of the wooden cross-pieces of the bench to clear the rocking arm.

Owing to limitations of space in the workshop, I could not obtain a complete photograph of the whole of the gear, and the upper countershaft had to be left out of the picture, but Fig. 3 shows the main part of it. The wire mesh guard which normally encloses the belting was removed to take the picture.

The motor is a very bulky 960 r.p.m. $\frac{1}{2}$-h.p. machine, and the smaller pulley seen just outside of its main driving pulley is no part of the gear, but only serves to drive a small air compressor occasionally, the finned cylinder of the compressor

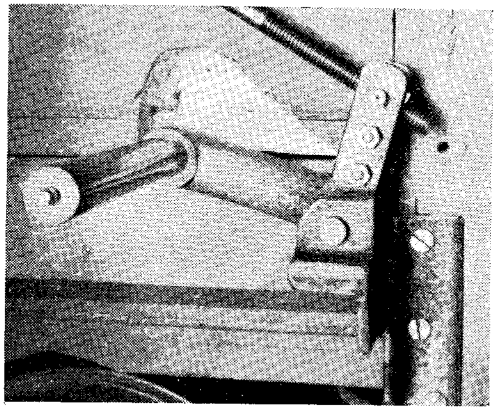


Fig. 4. Rocking arm and bracket with pulleys removed

is just seen on the right; the belt for this is only put on when air is required.

The tailstock end of the lathe can just be seen at the top between the upper belt, and the control handle is on the left of the picture; it is easily reached with the right hand when using the lathe.

Fig. 4 is a close-up view of the rocking arm with the pulleys removed, and the fearful gash in the end of the bench necessary to clear the arm in its upper position is very obvious. The rocking arm itself is an aluminium casting cast at home from scrap metal, and the bracket screwed to the bench, is welded up from bits of angle-iron.

The strain on the arm and bracket is not as much as it appears to be, as the pulls of the two belts more or less balance each other, and the pulleys, being cast in aluminium alloy, are not as heavy as they look. Lubrication of the spindle is looked after by the grease gun nipple seen at the outer end.

I have found this gear a most fascinating addition to the lathe, and can recommend the idea to all those who like to get the most from their tools.

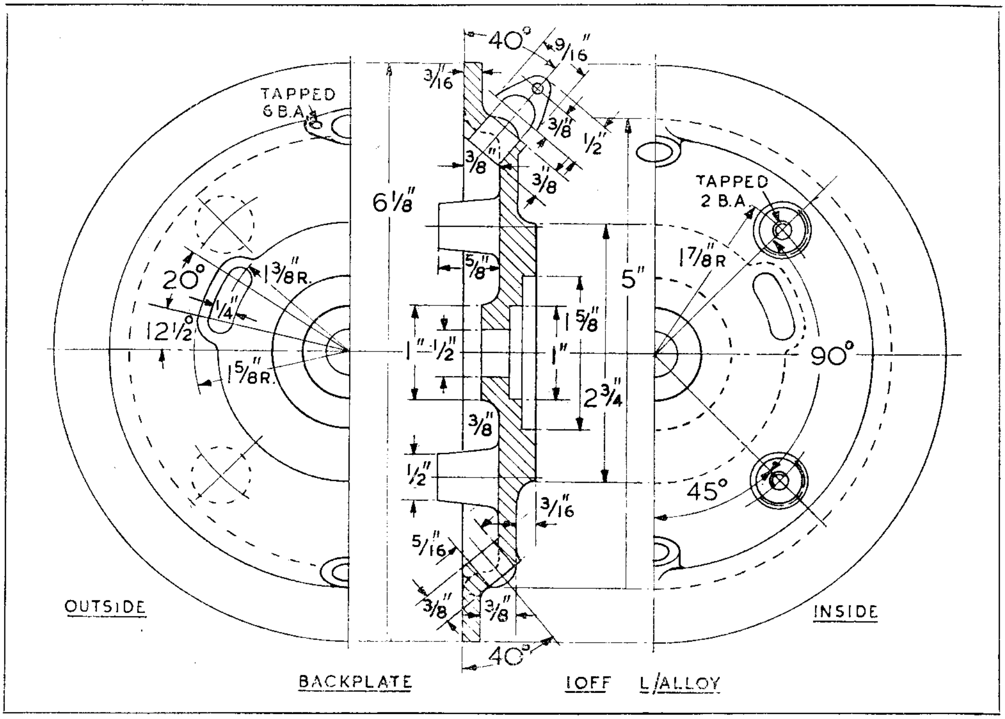
One word, of warning, however. Do not choose pulley sizes that will drive your lathe at excessive speeds, unless you are sure the bearings will stand it; it is also a very good plan to balance carefully all pulleys, including the cone pulley of the lathe mandrel itself, otherwise high speeds will cause excessive vibration of the whole outfit, which is fatal to good work, as well as spoiling one's pleasure in using "The King of Tools."

A Magneto for the "Busy Bee"

An entirely new design for a flywheel magneto-generator, suitable for all types of small power engines

by Edgar T. Westbury

IN the construction of the magneto, two castings only are specified, namely, the backplate and the flywheel shell, both in aluminium alloy. Although it is by no means impracticable to dispense with castings altogether, by fabricating the parts or machining them from the solid, it will probably be just as difficult, or even more so, to obtain suitable raw material, and the work is, of course, very much simplified if castings are employed. In both cases the castings are of relatively simple form, and the constructor who essays to make his own patterns, or even undertake the foundry work as well, will find little difficulty with them.



Backplate

Assuming that this is cast with the four projecting bosses on the inner surface, as specified, it is possible to hold it over the outside of these bosses, in the inverted jaws of the four-jaw chuck, for machining the outer face, with its recesses, and also the rim. The casting should be set to run as truly as possible in both planes, the principal reference surfaces being those parts outside the flat bolting face, as these have to be left unmachined. It will be observed that this backplate is designed to fit the standard magneto mounting plate (which also incorporates the outboard main bearing housing) as specified on the original engine drawings, so that if this component has already been machined, the recess in the backplate should be machined to fit closely on its spigot, and thereby ensure a true concentric register of the backplate with the engine shaft. The hole through the centre is also drilled at the same setting; its diameter is given as ½ in., but it should not fit the shaft too closely, and may, if desired, be given a fairly ample clearance to ensure that it cannot under any circumstances interfere with free running of the engine.

The reverse side of the casting can be dealt with by clamping it to the faceplate by toe-clamps over the rim at two or three places; concentric setting is of relatively small importance, as only facing operations are called for, but it may be set fairly true by bringing up the back centre, and entering it in the centre hole to locate the casting while the clamps are being

*Continued from page 579, "M.E.," October 30, 1952.

applied. All that has to be done at this setting is to face off the four bosses to the dimensions shown, $\frac{5}{8}$ in. from the recessed portion of the casting, or $\frac{1}{4}$ in. from the face of the outstanding rim, and to skim the face of the centre boss.

If any form of indexing gear is available (even the simplest appliance of this nature will suffice) the four holes in the bosses, for the attachment of the stator laminations, may be marked out, and if a drilling spindle is available, they may be drilled *in situ* as well. For these operations, however, the work must be set up truly concentric with the back register, and it is, therefore, worth while to machine up a spigot 1$\frac{5}{8}$ in. diameter to fit this recess, and mount the plate on it. A hole may be drilled and tapped in the centre of the spigot to take a set-screw, which will pull the backplate firmly back against the spigot, and hold it securely enough for these light operations.

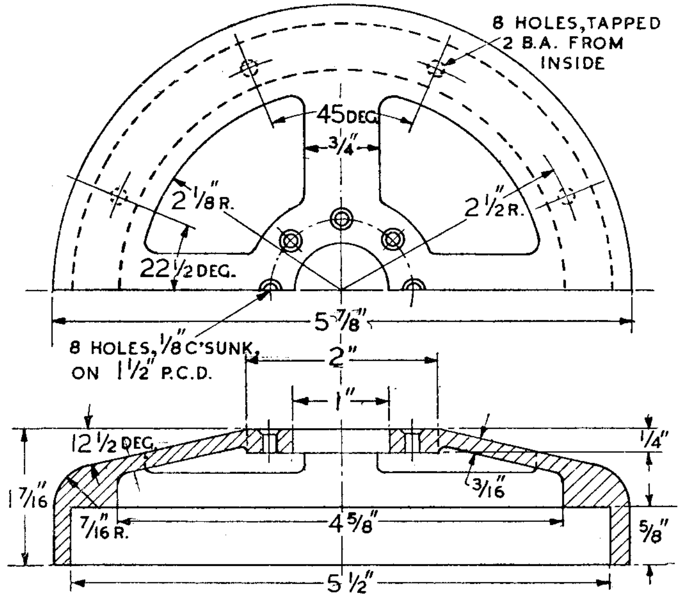
Some constructors, however, may prefer to leave the drilling of the bosses, until the stator laminations are fitted, and this is the most discreet course if the latter are pre-drilled, or made in the form of blanked and pierced stampings, as there is always the possibility that the distance between the holes in them may not coincide with that of the holes in the bosses, which are marked out in terms of angular and radial measurements. It is, however, always advisable to mark out the bosses as a guide to the proper location of the stators.

To drill and face the holes in the backplate which take the h.t. and l.t. terminals, the simplest method, if a vertical-slide with a swivelling base is available, is to clamp it to the slide-table, with the diametral centre-line of the holes horizontal, and swing the slide round to an angle of 50 deg., measured from the lathe faceplate (i.e. 40 deg. from the lathe axis). The angular setting is not absolutely critical, but should be as near as possible. A single tee-bolt will hold the casting, with the four feet resting on the slide-table, but as there is a danger of distorting it if the bolt is screwed up too tightly, a hardwood packing-piece of the appropriate thickness ($\frac{5}{16}$ in.) should be placed behind the centre boss to take the strain.

The vertical-slide will have to be overhung from the cross-slide to enable the large diameter casting to clear, but if there is any difficulty in this respect, it is quite practicable to mount the base of the slide directly on the lathe bed, or a plate attached thereto, as it does not have to be cross-traversed when once set up. After adjusting the casting to the correct centre-height, and verifying that the centre-line of the two holes is truly horizontal, the hole may be started with a centre-drill, opened out to finished size, and finally faced off truly with an end-mill. In the case of the h.t. terminal seating, the flange will have to be faced right across by traversing the work vertically ; this is not necessary in the case of the l.t. seating, but it should be noted that this needs spot-facing on the inside surface, and it may be necessary to make or adapt a facing cutter or pin drill for this job.

If the use of a vertical-slide is impracticable, an alternative method of dealing with this operation would be to made a hardwood block, having a top face at 40 deg. to its base, and use this to mount the casting on the cross-slide at the required angle. The work is shifted up or down the inclined surface to adjust the height, and may be fixed in position by a single large wood-screw and washer. In this case the diametral centre-line is horizontal, in the cross plane relative to the lathe axis, and the traversing movement necessary for milling the flange face can be obtained on the cross-slide.

All that remains to be done on this casting is to drill and slot out the fixing holes in the mounting face—these may be either filed or milled, according to facilities available—and to drill and tap the 6-B.A. holes in the terminal flange, but the latter may be left until the insulator is fitted. Other holes have to be drilled for fixing the contact-breaker and condenser, but these also are best deferred until the time comes to fit the components in place.



FLYWHEEL 1 OFF L/ALLOY

Flywheel

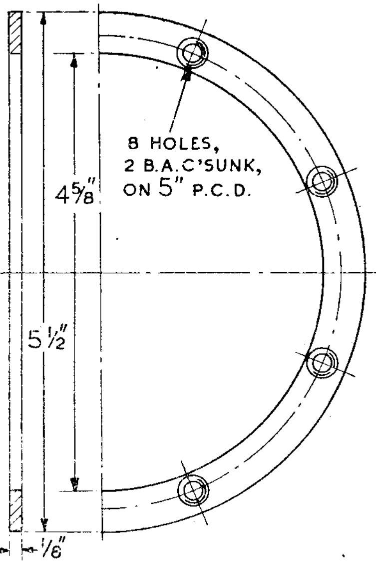
If, as is quite probable, this casting is too large to be held in the four-jaw chuck, a good

deal of the essential work on it can be done by mounting it on the faceplate, by means of bolts through the four apertures, and suitable clamp plates to bridge across them. The outside should be dealt with first, as it will be found easier to obtain a reasonable finish on the outer rim when it is supported in this way than at a later stage in the operations. It should be set to run as truly as possible, and if there is any pronounced inaccuracy of the face, it may be found necessary, as a preliminary, to file this so that it rests fairly on the faceplate and does not produce side wobble.

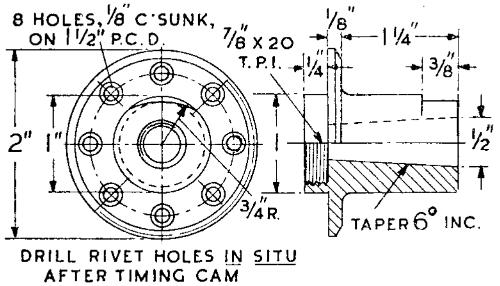
The rim may be machined, approaching as closely as possible to the faceplate without digging into it, then the flat centre face ; the centre hole may be bored undersize to produce a true reference surface, but should not be finished at this stage. It will also be possible to machine, or at least rough out, a part of the angular front face, so far as permitted by the clamps, and to round off the radius where this meets the rim.

The casting may now be reversed, the centre face being clamped against the faceplate, and set up to run truly, checking by the centre hole and also the machined portion of the rim. If one is lucky enough to possess a set of the old-fashioned "faceplate dogs" (now apparently obsolete, though just as useful as they ever were !) they may be set up to bear on the outside of the rim, with slips of wood or leather interposed, and not tightened up sufficiently to cause risk of distortion. These will not only assist in locating the work, and insure against the risk of it shifting, but also act as a very effective deterrent to chattering. The facing of the rim, and most of the internal machining except in the region of the clamps, may now be carried out ; the centre hole is, of course, now bored out to finished size at this setting.

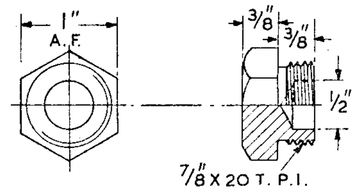
A spigoted mandrel may be used to mount the flywheel for machining those parts not hitherto accessible, but most constructors will probably find it more convenient to wait until the hub is fitted, and the assembly can be mounted on its own shaft for final truing up. Incidentally, the setting of the lathe top-slide for machining the face angle of 12½ deg. (not critical) may be found difficult in some cases, but can usually be "wangled" with a little ingenuity, and some of the contributors in THE MODEL ENGINEER have already given hints on ways and means of dealing with this problem.



CHEEK PLATE 1 OFF L/ALLOY



HUB, WITH BREAKER CAM 1 OFF M.S.



EXTRACTOR 1 OFF M.S.

If a chuck large enough to hold the flywheel in both positions happens to be available, procedure is very much simplified, and the whole of the external and internal angular surfaces can be reached ; but when the work is gripped in this way, care must be taken to see that it is not distorted by the pressure of the jaws, and also that face truth is preserved.

The eight holes for the rivets which secure the flywheel to the hub should be marked out and drilled, preferably with the aid of indexing gear and a drilling spindle.

Hub

This is made from mild-steel, and may be machined on most of the essential surfaces at one setting if a surplus length of about ¾ in. is allowed on the material to serve as a chucking-piece. Alternatively, the centre may be drilled and taper bored, and then be mounted on a taper mandrel for external machining. This, of course, is the approved method "according to the book," but its success depends entirely upon the use of an absolutely true-running mandrel, and if this

cannot be assured, it is but a snare and a delusion. I have found it quite satisfactory, and more expeditious, to employ the "one-setting" method, the spigot at the end being machined with a left-hand side tool, to micrometer measurement, and the same tool used for facing the flange.

Accurate Taper

The accuracy and finish of the taper are most important factors in any fitting of this nature, and not only myself, but "Duplex" and other writers have emphasised the necessity of setting the tool exactly on centre height, and "running out" the cut, by several passes at the final feed setting, to eliminate spring. If one has a good taper reamer of the correct angle, by all means use it to *finish* the surface—but only by taking a light scrape, not by entering it into a parallel hole and hoping for the best! The resultant hole will probably be far from circular, and possibly eccentric as well, if you do.

If the hub is made with a chucking-piece, it will be a sound policy to machine the cam surface on it before parting off. The chucking-piece is set over in the four-jaw chuck until the running centre is just about coincident with the edge of the hole, as can be checked by advancing the back centre until it almost touches the work. It is not necessary to work to fine limits in the amount of eccentricity, as the function of the curve produced by this operation is simply to avoid an abrupt change of contour on the cam, which might tend to cause bouncing of the contact-breaker rocker. As this magneto is not intended for use on a super-high-speed engine, this measure suffices for practical purposes, and it is not necessary to go to the trouble of generating a scientifically-designed cam contour.

A cut is taken for a length of $\frac{3}{8}$ in., to such a depth as to cut away about 90 deg. of the surface; here again, it is not necessary to split hairs, as the cam timing is, at this stage, capable of adjustment relative to the rotor poles, and in the interests of simplicity, it is intended that this operation should be left till the assembly stage. No doubt the precision experts would like to see everything tidied up and the exact angles of essential locations stated definitely on the drawings. This, of course, would be absolutely necessary in production work, and it would be the responsibility of the jig and tool designer to see that ways and means of working precisely to the specified angles were arranged. It should be noted that not only are the relative angular timing of the rotor and stator poles, and that of the cam, highly important, but precision in these respects could be rendered quite futile by a slight error in the location or dimensions of the contact-breaker components. While it is not by any means impossible to do all these things in the approved tool room manner, I have found by experience that it is much easier and quicker to "offer up" the job, and adjust accordingly; I think most of my readers will agree.

The slight corners where the concentric and eccentric curves meet should be eased off with a superfine file, and the cam then re-centred and polished with an oilstone slip while running, prior to parting-off. In the event of the cam being machined on a mandrel, the eccentric setting may be obtained by holding the mandrel in a Keats vee-angle plate or similar eccentric fixture. This cam is arranged to allow the contacts to close for slightly less than a complete half-cycle, thus giving ample time for full build-up of current in the primary circuit before the break takes place.

Another point which should be noted in the design of the hub is that the taper does not correspond with that specified for the fitting of the Bantamag. It could, of course, be made interchangeable if desired, but there are very good reasons for the difference, as the success of a taper fit in a flywheel depends largely on providing an adequate bearing surface area, not to mention ample strength in the shaft and the thread which takes the securing nut. In my opinion, and that of many other constructors, the original fitting dimensions leave much to be desired, but this matter was entirely outside my control. If the engine has already been built, it will, of course, be necessary to make a new shaft journal to conform to the new fitting, but this is not a very big job. Note that no keyway is shown in the hub; this also is optional, but it is unnecessary to key the flywheel if the taper fit is adequate, and I regard keying as a definite disadvantage, except in cases where assembly must be made absolutely foolproof, as applies in commercial production.

Extractor

The front end of the hub is recessed to allow the securing nut to be sunk flush with the surface, and I have shown this recess internally threaded to take an extractor. I regard the use of a simple extractor of this type as well worth while; taper-fitted components are often damaged, and indeed completely ruined, by trying to remove them with unsuitable tools. The extractor shown here is arranged to screw into the recess of the flywheel hub, after the shaft nut has been removed, and the depth of the centre hole is arranged so that the end of it will make contact with the end of the shaft before it is fully home in the hub. When screwed further in, it will draw the hub off the taper. Some extractors of this type are fitted with a centre set-screw to bear on the shaft, but there is no particular advantage in this unless a wide latitude, to suit varying lengths of shafts, is required. An alternative to the extractor would be to use a "captive nut," in other words a nut with an integral base collar, trapped in the recess by a ring or washer held in place by the rivets which secure the flywheel. This is a very effective device, but there are disadvantages in not being able to remove the nut from the hub in any circumstances, and I prefer to make the extractor a separate unit.

Cheek Plate

This is simply a ring which can be trepanned from $\frac{1}{8}$ in. light alloy sheet, and is used to clamp in place the magnets and their laminated poles. It should be made a good fit inside the flywheel rim, but its internal dimensions are not critical. The screw holes may be left until the laminations are ready to be fitted.

(*To be continued*)

"Britannia" in $3\frac{1}{2}$-in. Gauge

by "L.B.S.C."

Boiler Staying, and the Smokebox

WE now come to what is probably the most tedious job on the whole boiler, viz. the staying; but it just *has* to be done, so in the words of a well-known radio comedian, let's get on with it. There are four longitudinal stays extending the full length of the boiler; six cross stays in the Belpaire firebox wrapper; forty-one small stays in each side of the firebox, plus two at each side of the combustion chamber; sixteen in the throatplate, and fourteen in the backhead—nine below the level of the firehole ring, and five above. The *modus operandi* was fully described in the serial on *Tich*, but here is a resume of the operations, as applied to the comparatively big boiler. The job is a little more complicated, but decidedly no more difficult.

First you'll need twenty blind nipples for securing the longitudinal and wrapper stays; these are made from hexagon rod, $\frac{3}{8}$ in. across the flats. Use bronze or gunmetal if available, but brass will do at a pinch. Chuck in three-jaw, face the end, centre, drill down $\frac{3}{8}$ in. full depth with 5/32-in. or No. 22 drill, and tap $\frac{3}{16}$ in. $\times$ 40. Turn down $\frac{3}{8}$ in. of the outside to $\frac{5}{16}$ in. diameter, and screw $\frac{5}{16}$ in. $\times$ 40. Both inside and outside threads must be same pitch. Part off at $\frac{3}{16}$ in. from the shoulder, reverse in chuck, and chamfer the corners of the hexagon. A tapped bush can be used to hold the nipples if desired, but they can be held sufficiently tight for the chamfering, if the screwed end is placed in the chuck jaws. It is "against the rules," but many of Curly's antics fall in that category, and the locomotives don't seem any the worse for it!

Both the longitudinal and wrapper stays are made from $\frac{3}{16}$ in. copper rod. I'm still using up lengths of wire that originally did duty on a North Country Milly-Amp tramway that was put out of business by the ubiquitous motor-bus. Poor old trams! As a gasoline-cart driver, naturally I was glad to see them disappear from our part of the universe; yet somehow I miss the old rattle-bang-clank of the wheels over the rail-joints and crossing frogs, and the sssssss—phit! of the trolley-wheel on the wire. Isn't it curious how the wheel of fortune turns the complete circle? When my granny was born, the only form of public transport on land, was the stage coach, drawn by four-legged hay-burners; she was two years old when the *Rocket* ran at Rainhill, so that I'm really a living link with the past. The steam locomotive ran the coaches off the roads, and held sway for the next 70 years or so. Then Milly Amp comes on the scene, and proceeds to give the steam engine a "twopenny one" with her electric tramways and tube railways. Then the stage-coach *Phoenix* arises from the ashes, and goes for the blessed lot; in the form of the motor coach and bus, it not only shuts up the branch lines where steam did a comfortable trade, but pushes Milly's tramway cars out of the way, and competes with the railway for the long-distance traffic. Then the modernised versions of the village carrier's cart, the motor van and lorry, grab a big share of freight traffic; so that the steam locomotive, which ran its competitors off the roads, is itself being run off the rails! However, this isn't boilersmithing, so please forgive an old fogey's passing thoughts of days gone by, and we'll proceed to business.

Barrel and Wrapper Stays

If copper rod isn't available for the longitudinal and cross stays, drawn bronze or gunmetal can be used, but don't use brass. Even best quality brass will waste away by virtue of the zinc content, whilst screw-rod is practically useless, as it not only wastes in the middle, but goes brittle and will snap easily. For the long stays, four lengths of $\frac{3}{16}$ in. rod, each $19\frac{5}{8}$ in. long, will be required; and for the cross stays, six lengths of same diameter, but only $4\frac{1}{2}$ in. long. Screw all the lot $\frac{3}{16}$ in. $\times$ 40 at one go, putting approximately $\frac{3}{8}$ in. of thread on each end, holding the rod in the three-jaw, and the die in the tailstock holder, and don't forget that a spot of cutting oil ensures clean threads on copper and bronze.

The holes for the blind nipples should be already in the smokebox tubeplate, if it is made to the published drawing, so there are only the holes to drill and tap in the backhead. These are located at $1\frac{1}{2}$ in. from the top of the wrapper; the spacing is the same as shown in the drawing of the smokebox tubeplate, the two centre holes being $\frac{7}{8}$ in. apart, and the other $1\frac{1}{16}$ in. away. Drill the holes first with a small drill, say, $\frac{1}{8}$ in. or No. 30, then put the 9/32-in. drill through, finally tapping $\frac{5}{16}$ in. $\times$ 40, and not forgetting a drop of cutting oil on the tap. To insert the stays easily, I use a long piece of thin-walled $\frac{1}{4}$-in. tube, first putting this through a nipple hole in the smokebox tubeplate, and wangling it through the corresponding hole in the backhead. Screw one of the blind nipples on to a stay rod, about three threads, then insert into the tube, and push it home, at the same time withdrawing the tube from the smokebox tubeplate. This wheeze guides the stay easily to its destination. Screw the nipple right home in the backhead; the rod will then be just protruding through the hole in the smokebox tubeplate. Screw another nipple on to that, and keep turning (I use a home-made box-spanner, like a chuck key) until the outer threads engage in the tapped hole, and the shoulder finally jams hard against the tubeplate. The stay rod is then locked solid between the two nipples.

The holes for the wrapper stays are drilled at the location shown in the longitudinal section of

the boiler, the rearmost one being set 1 in. from the edge of the wrapper sheet, and $1\frac{3}{8}$ in. below the top, and the others at $\frac{15}{16}$ in. centres. Drill $\frac{1}{8}$ in. pilot holes as before, following with 9/32 in. drill; but after drilling, poke a 9/32-in. parallel reamer into each hole, and while twisting it, bring it to a horizontal position, so that it points straight at the hole in the opposite side of the firebox wrapper. The holes have also to be tapped at the same angle; and if you take a look at the cross stay shown in the cross-section of the boiler, illustrated on page 252 of August 21st issue, you'll see why, without further explanation. How on earth do we do that? ask our inexperienced friends. Simple, my dear Watson, says Curlylock Holmes. I use a tap with a pilot pin (commercial article—a speciality of Kennion's) and on the pilot pin I put a piece of 9/32-in. rod long enough to reach beyond the hole in the opposite side of the firebox wrapper. The rod has a hole drilled in the end, a tight fit for the pilot pin on the tap. The rod is inserted into the hole to be tapped, pushed right through the firebox casing until it comes through the opposite hole, and then the tap is operated in the usual way, the rod keeping it in line with the opposite hole.

"All very fine for you, but I haven't got a pilot tap," wails Bro. Pessimist. Oh, these boys! Chuck a bit of $\frac{5}{16}$-in. round silver-steel in the three-jaw; face, centre, and drill No. 32 for $\frac{1}{4}$ in. depth. Put $\frac{3}{8}$ in. of $\frac{5}{16}$-in. $\times$ 40 thread on the outside, and part off about 2 in. from the end. File four flats on the screwed part, tapering towards the end, and file $\frac{1}{4}$ in. of the other end square, by the same method I gave for squaring the ends of valve pins. Harden and temper the screwed end to dark yellow, drive a bit of $\frac{1}{8}$ in. round steel into the hole, and there is your pilot tap. Eh? Bless your heart and soul, I never said it *would* cut a perfect thread; but what on earth is to prevent anybody running a standard $\frac{5}{16}$-in. $\times$ 40 plug tap into the hole, after the improvised pilot tap has started the threads at the correct angle? I did hear once about somebody who couldn't see the wood for trees.

It is obvious that the heads of the blind nipples won't bear fairly on the inclined sides of the firebox wrapper; but this is easily got over, by putting a wedge-shaped washer under each head. Chuck a bit of $\frac{7}{16}$-in. or $\frac{1}{2}$-in. round brass rod, face, centre, drill $\frac{5}{16}$ in. clearing, part off a dozen $\frac{1}{8}$ in. slices, and file to shape. Put a bit of $\frac{5}{16}$-in. round rod vertically in the bench vice, with about 3/32 in. standing above the jaws, and slip the washers over it, to file them. The short stays can be threaded through without any need for a guide, as used for the long ones.

There have been a lot of moans and groans from Messrs. I. Knowitall & Co. because I specify a large number of small firebox stays instead of a few big ones. Followers of these notes should know by this time, that Curly doesn't make rash statements, nor do I give instructions without very good reasons; and I have found that the "small stays and plenty of 'em" stunt gives a much stronger firebox than the kind advocated by the unreliable firm mentioned above. What they overlook is the very thing that matters most, viz. the amount of unsupported metal between the stayheads. If, for example, you used half the given number of $\frac{3}{16}$-in. stays at $1\frac{1}{4}$ in. centres, the firebox would soon look like an old-fashioned buttoned cushion; and the strain on the widely-spaced stays would be much greater, in proportion, than on those in the arrangement specified. Experience still teaches, but it is experience *on the track* that teaches best; you can "prove" anything by figures!

The staybolts should be made from $\frac{1}{8}$-in. copper rod or wire. The easiest way to do the job, is first to drill all the holes in firebox wrapper, backhead, and throatplate, with a No. 40 drill, running same right into the firebox. Then tap through both plates with a 5-B.A. tap having a 3/32-in. pilot pin; a commercial article sold by Kennion, Reeves and others. This ensures that the threads in both plates are in alignment and also in continuity (says the third programme). Cut a few lengths of $\frac{1}{8}$-in. soft copper rod or wire about 6 in. long, and put about $\frac{5}{8}$ in. or so, of 5-B.A. thread on each end. Clamp a small tap-wrench in the middle, and screw one end of the rod into a stay hole, until the end comes through into the firebox, and the threaded part seats home and jams in the outer hole. Snip off about $\frac{1}{8}$ in. from the surface of the plate, then repeat the operation until all the holes are filled, re-screwing the rods after snipping off, until they are all used up. As each stay is fitted, screw a commercial brass 5-B.A. locknut on the projecting end inside the firebox, screw it up tightly, and snip off any surplus thread. Put a bit of iron bar in the bench vice, letting it project from the side of the jaws. Rest the locknut on it, and hammer down the outside stub into a cup head, being careful to hit the stay and not the copper sheet. Finally, give all the nuts a tighten-up with a small spanner.

The two stays in each side of the combustion chamber, are fitted in the same way, but are made from 5/32-in. rod, screwed 5/32 in. $\times$ 40. Their purpose is to support that part of the firebox wrapper overlapping the back end of the combustion chamber, as the chamber itself is self-supporting. Drill the holes so that the stays will be at right-angles to the combustion-chamber.

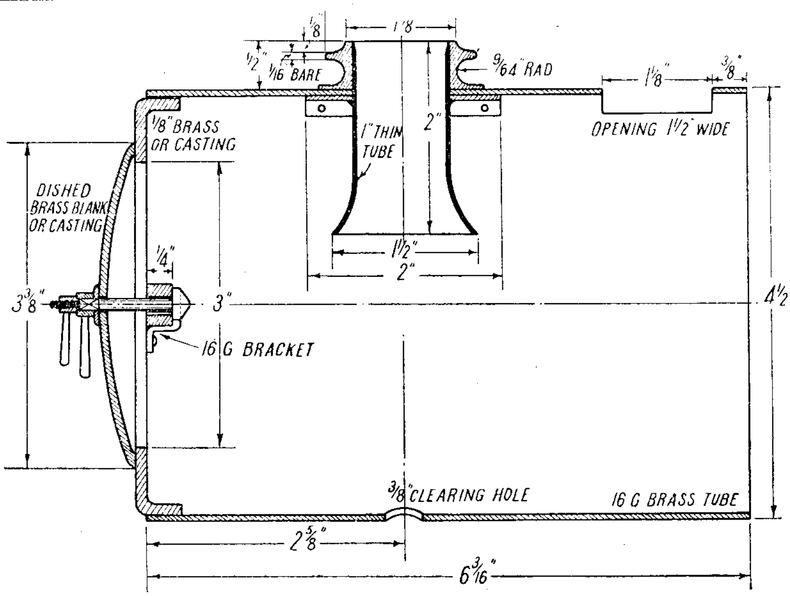
How to Sweat Up the Stays

The easiest way I know of sweating over the stayheads and nuts, is as follows. By the good rights, if the threads are tight and not torn, and the nuts properly seated, no sweating should be necessary; but it is advisable to take precautions! Brush all over the stayheads and nuts with a liquid flux, such as Baker's fluid, killed spirits of salts, chloride of zinc, or similar; don't on any account use a paste flux. Put the boiler in the brazing pan, and heat it evenly to the melting point of solder. Lay it on its side, melt some plumbers' solder among the stayheads and nuts, and brush it all over them by aid of a small wire brush, which can be made by driving a small bunch of thin iron wires into the end of a bit of tube, flattening it to hold them tightly. Cover the whole of the inside firebox, and the stayed parts of the wrapper, backhead and throatplate, keeping up the heat, and applying more flux to any part where the solder doesn't

seem to be "taking." When all are done, let the boiler cool off, and wash it thoroughly in running water, using an old nailbrush or something similar, to remove all traces of the flux. If any remains, it will soon show green on the copper.

A correspondent recently sent me a sample of a soldering preparation called "Fryolux," a paste made from powdered solder and liquid flux. It is claimed that this will form a perfect seal if painted over the job, and a blowlamp applied to heat it until it melts. At time of writing, I haven't tried it for sweating stayheads and nuts, but it certainly sounds promising.

The boiler can now be tested by water pressure to 160 lb. in exactly the same way as described for testing the *Tich* boiler. If any leaks occur, they should be attended to before proceeding further. I have already described several times how to deal with small leaks.



Section of Smokebox

Smokebox

Before starting to make any boiler fittings, we might as well make the smokebox, and then you'll get a distant-signal view of what the completed job is going to look like. The barrel of the smokebox can be made from 16-gauge brass, copper, or steel tube $4\frac{1}{2}$ in. diameter, or may be rolled up out of sheet material, the joint being made by butting the ends together, riveting a strip of the self-material, about $\frac{1}{2}$ in. wide, on the inside, and brazing the joint, so that it is perfectly airtight. The joint may also be made by welding, and in that case the butt strip may be dispensed with. If it is used, it should stop short at $\frac{1}{2}$ in. from each end, otherwise it will be difficult to fit the front plate, and to fit the smokebox to the projecting flange on the boiler barrel. For the same reason, a lap joint shouldn't be be used. In any case, the smokebox barrel should be squared off in the lathe, to a length of $6\frac{3}{16}$ in., holding one end in the chuck, and supporting the other with the back centre, both ends being plugged with discs of wood, or anything else that you may have handy.

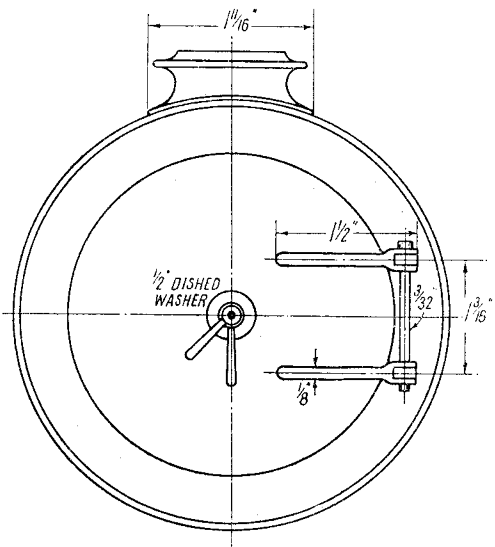
At $2\frac{5}{8}$ in. from one end, cut a 1-in. hole; and right opposite it, drill a $\frac{3}{8}$-in. clearing hole for the blastpipe. Draw a circle at the location of the big hole; drill undersize, or drill a ring of holes and knock out the piece, finishing by filing almost to the line, and "sizing" with a 1-in. reamer if available. The liner is a 2-in. length of 1-in. thin tube, brass, copper or steel. Bell out one end to $1\frac{1}{2}$ in. diameter, easily done by holding the tube on the edge of a block of lead and judiciously applying the ball end of the hammer; "exhibition finish" is not needed. The bell can also be spun out. The other end is tapered to a sharp edge. Maybe our approved advertisers will supply a casting for the liner, which can be machined inside and out. It is attached to the smokebox shell by a square flange, made from a piece of 16-gauge metal 2 in. square, with a 1-in. hole in the middle, and bent to the radius of the inside of the smokebox barrel. Put this on the liner at $\frac{9}{16}$ in. from the straight end, and silver-solder it with the minimum of silver-solder necessary to form a tiny fillet on the concave side. If any seeps through to the convex side, file it off, or the plate won't make proper contact with the smokebox shell. Smear some plumbers' jointing around it, push it through the hole in the shell from the inside, and secure with brass

countersunk screws, about 3/32 in. or 7 B.A., at each corner, with brass nuts inside.

The outside chimney is turned from a casting. Hold it in three-jaw, and bore it to a push fit on the liner; then mount it on a mandrel (bit of round metal or wood held in chuck) and turn the outside to the profile shown. Inspector Meticulous always takes a mighty critical quiz at the chimney, so be sure and get the curves right! It can be saddled to the smokebox by removing any roughness with a file, and rubbing it on a piece of emery-cloth or other abrasive, laid on the smokebox barrel. The slight difference in the curve, caused by the thickness of the emery-cloth isn't noticeable.

Smokebox Front and Door

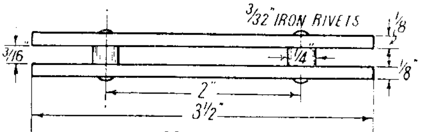
Our approved advertisers will probably supply castings for the smokebox front, or ring, as it is



Smokebox front

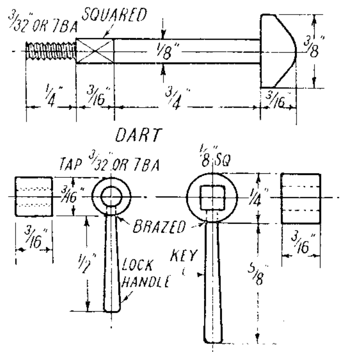
sometimes known, and the door, in which case only plain turning, and judicious use of a file is needed to finish to size. The hinge lugs, if cast on, prevent the whole of the casting being faced, and only the seating for the door can be machined; but the outside can be turned to a drive fit in the smokebox barrel, by mounting the casting with the door-hole on the appropriate steps of the inside jaws of the self-centring chuck. The door casting will have a chucking spigot cast on the convex side, to hold in the chuck whilst the edge is being turned to fit airtight against the smokebox front. The outside cannot be turned if the hinges are cast on, but must be finished by file and emery-cloth.

Alternatively, the front ring can be made from a circle of $\frac{1}{8}$-in. brass sheet, in exactly the same manner as the smokebox tubeplate; refer back to the instructions for that. After flanging, and turning to fit the smokebox barrel, chuck in three-jaw, convex side outwards, and by aid of a parting tool set crosswise in the rest, cut a hole 3 in. diameter. Then face off the remainder, and radius the edge. The door can be formed from a $\frac{1}{8}$ in. brass blank $3\frac{1}{2}$ in. diameter. Anneal it, and dish it by laying it on a block of lead, and hitting it with the ball end of the hammer,



CROSSBAR

starting from the middle and keeping on until it resembles a saucer (it will be a "flying saucer" all right when the engine is on the road!). Chuck in three-jaw, concave side out; centre, and drill a No. 30 hole through the middle, then face off a circle about 1 in. diameter around the hole. Chuck a stub of brass rod about $\frac{3}{4}$ in. or so in diameter, turn a $\frac{1}{8}$-in. pip on the end, and



truly face it around the pip. Put this through the hole in the door blank, same lying concave side up in the brazing pan; wet with soldering fluid, put a bead of solder alongside, and heat the lot until the solder melts. Wash off when cool, then grip the stub in the three-jaw, and the door blank can then be turned all over the outside, and the contact edge faced off, after which, the stub can be melted out.

Smokebox Details

The hinges, crossbar, dart and handles are similar to those described in full detail for previous engines, so there is no need to go through the whole ritual again. The crossbar is shown half-size, and the dart and handles full size, in the accompanying illustrations. Anybody needing information on the method of making them, has only to refer back to the *Tich* notes. There is one variation; the ends of the hinge straps are forked. Slot them as described for valve forks, and fit over the lugs as shown.

A Tobacco Shredding Machine

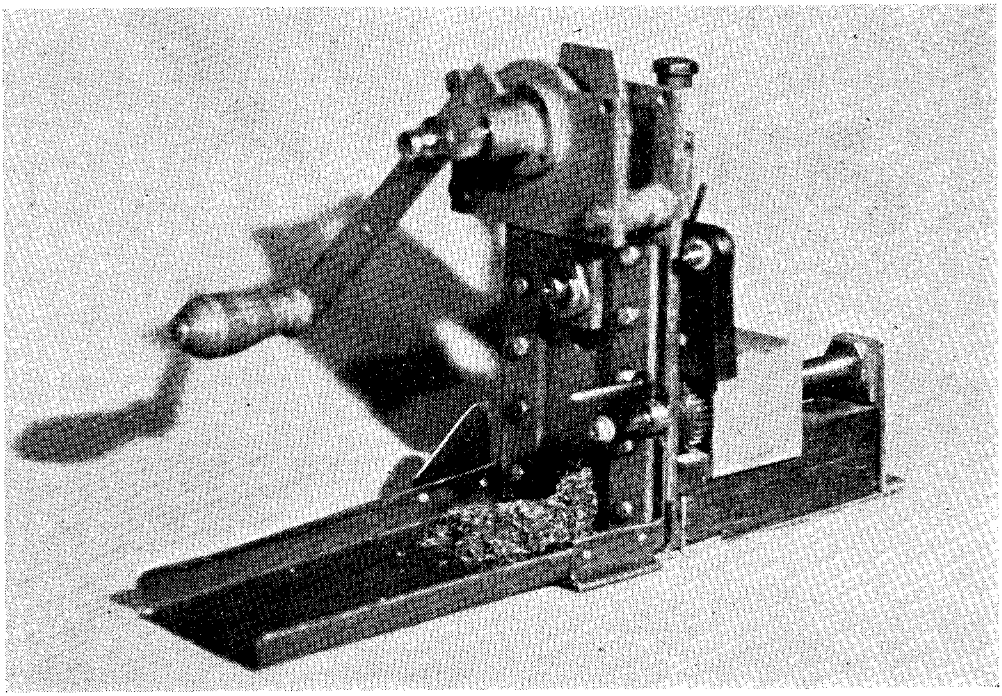
with Automatic Feed

by C. C. Allison, A.R.C.A. (Lond.)

I GROW and cure my own tobacco, which seems to me more sensible than growing vegetables—if one smokes. The product is not quite up to the more expensive commercial brands, but better than some of the cheaper varieties. Although my friends and colleagues have been heard to murmur about " the smell of camels across the desert " when I am around, it is only the story of " sour grapes " !

Shredding tobacco is tedious, and this machine was inspired by a small photograph in a gardening magazine, lent to me by a friend, Mr. J. Ensten. I could not make out how the commercial article worked, and so made a few sketches and produced what I hope is clear from the photographs, supplemented by the drawing.

The machine has automatic feed, with some degree of adjustment. I had to construct it mainly from scrap, and it is capable of being modified considerably as to sizes, etc. It is built round a Stanley plane blade, 2 in. wide. This slides up and down an L-shaped slot formed by a 1/6 in. packing strip, overhung $\frac{1}{8}$ in. or so either side by $\frac{3}{16}$ in. × 1 in. cover plates, the lot being bolted down with 2-B.A. bolts, as in drawing. The plane blade is attached to the crank by a die block (made rather like the die block in Stephenson's link motion, only it is in two halves bolted together) to adjust the stroke (as on some shaping machines). The front of this block takes the " big-end " pin, and at the back the arm plate for the pawl. The disc crank and handle are straightforward machining jobs ; they are stood off by steel tubes supporting a small front plate, as in the drawing. The metal tray in front is clipped tight to the baseplate, and is made from a Castrol oil drum.



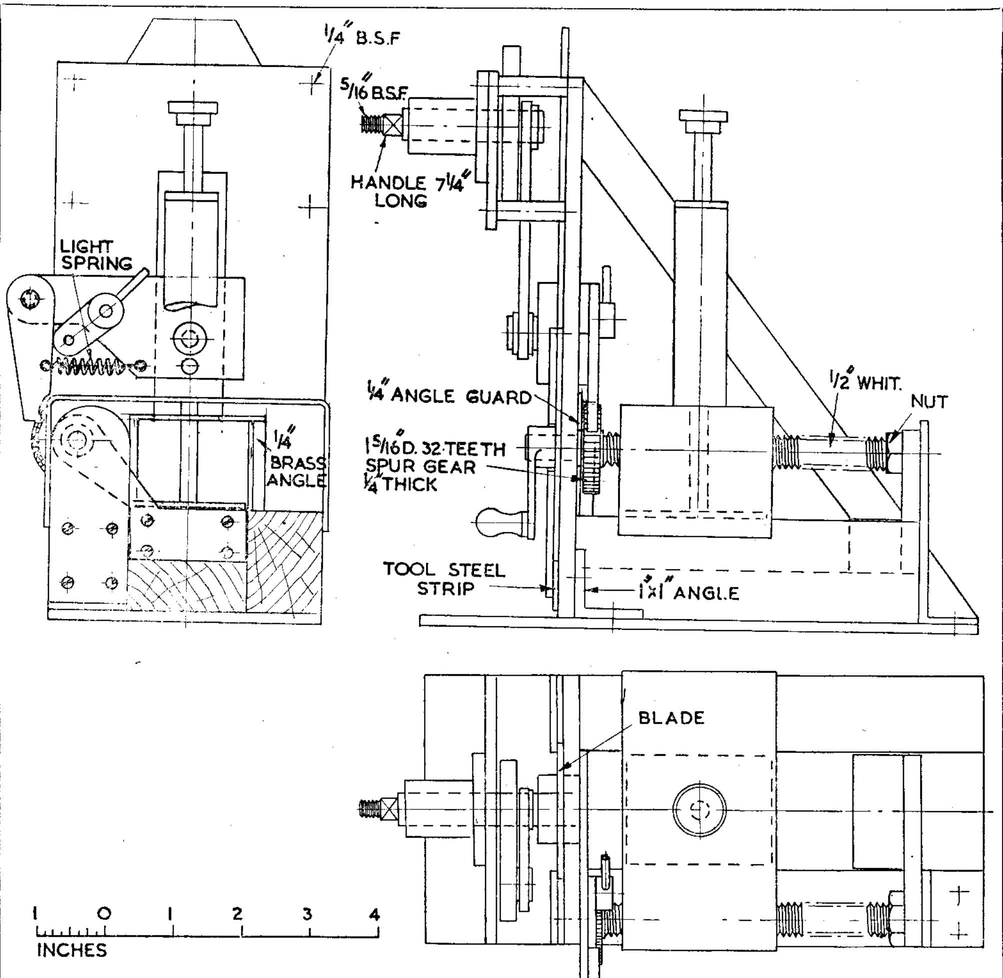
Front view, showing clip-on tray

Turning to the back of the machine, the tobacco trough is of hard wood, and the channel was planed out on a shaper. The leadscrew on the left, for automatic feed, is $\frac{1}{2}$-in. Whit. studding turned down at either end, at the front, for the small handle to return the feed block, and at the back, for the supporting bearing. The leadscrew has also a small spur gear (*ex*-car wreckers) keyed on and the latter is protected from coming in contact with the tobacco by a brass guard.

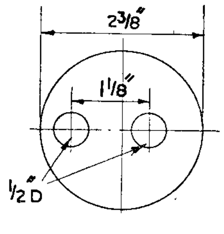
The bridge-piece immediately behind the upright frame supports a spring plunger which keeps the tobacco pressed down in the trough. The bridge is bent up from old hot-water tank plating, $\frac{1}{8}$ in. thick, and the tube containing the spring plunger is made from electric cable conduit. All screws and bolts are either 2 or 4 B.A., *ex*-THE MODEL ENGINEER small ads. The tobacco is pushed from behind as the leadscrew revolves under the intermittent action of the large pawl. I made the pawl on the heavy side to prevent bouncing, before fitting the spring. The pawl is, therefore, unnecessarily heavy. A small lever at the side, enables limited adjustment to be made in the rate of feed by alteration to the number of teeth the pawl gathers. In the extreme outward position the pawl is out of action altogether ; full in, produces fine shredding.

Returning to the main upright plate. It is secured to the $\frac{1}{8}$ in. baseplate by 1 in. × 1 in. M.S. angle. The slot cut in the plate is wider at the bottom, giving a spade-shaped aperture through which the tobacco is passed. The bottom edge of the aperture constitutes the second blade of the shears, the plane blade the other. I soon found that the rubbing action of the harder plane-steel blunted the mild-steel edge and, therefore, a hardened tool-steel insert strip 4 in. × 23/32 in. × $\frac{1}{16}$ in. was prepared and screwed into the slot shown in drawing. The large slot in the upright plate was produced by drilling, sawing and filing in the usual way.

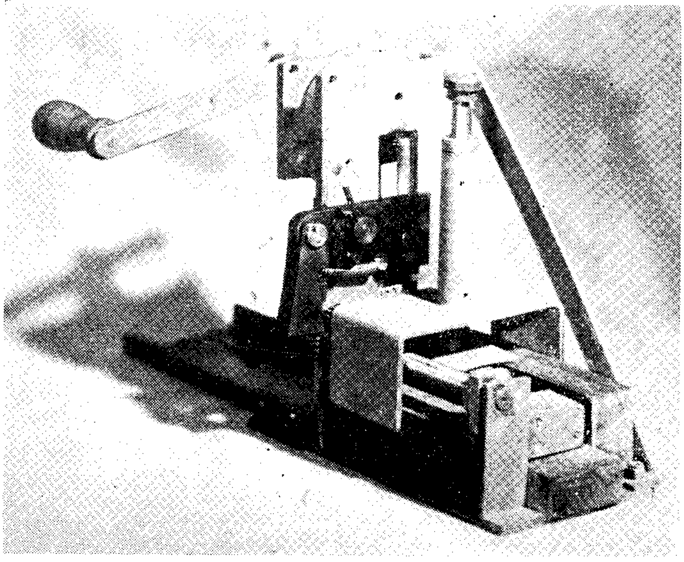
In use, the machine is loaded with a roll of tobacco, approximately $1\frac{1}{4}$ in. dia. × 3 in., placed in the trough and under the spring plunger, the feed block is then advanced by the smaller



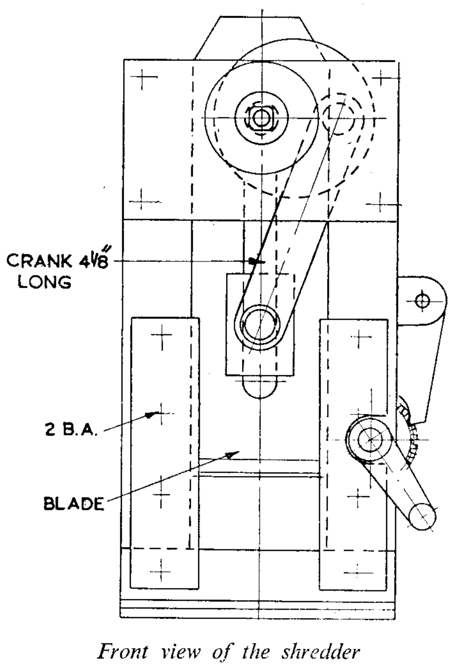
Elevation and plan of the tobacco shredder



Disc crank (2¼ in. stroke)



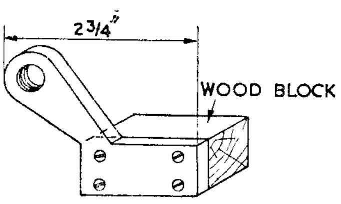
Back view of the machine



Front view of the shredder

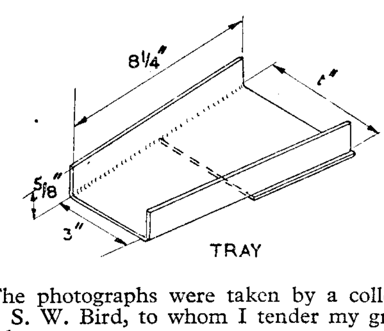
of the two handles at the front of the machine. It is surprising the large amount of power the shredding action takes. However, provided the tobacco is not put in too dry or too wet, ¼ lb. can be shredded in far less time than using a knife. I should point out that the machine must be firmly held sideways in a vice or bolted down on a table.

Friends have suggested that the amount of power used could be reduced by sloping the blade cutting-edge as in the manner of printers' guillotines. I think, also, it would be possible



DETAIL OF PUSH BLOCK

to improve the feed arrangement. However, I wished to make the machine as simple as possible, as my time is very limited these days, even though the present article is a distinct aid to blowing cheaper—much cheaper—smoke rings.



TRAY

The photographs were taken by a colleague, Mr. S. W. Bird, to whom I tender my grateful thanks.

A LATHE CONVERSION TO GEARED DRIVE

by Geoffrey F. Cooper

MY model engineering career began in the early days of the last war, with the purchase of a second-hand " Zyto " 3 in. lathe with treadle stand. This equipment did good service, including the machining work on a " M.E." Road Roller engine, but in the course of engineering training I had the experience of using modern centre lathes with built-in motors and all-geared headstocks. The greater ease of working, and, in particular, the ability to stand perfectly still when doing some delicate operation, with neither lathe nor myself rocking in sympathy with the treadle gear, decided me to motorise my own lathe at the first opportunity.

Disliking the idea of always changing the cone pulley belt to obtain variations in speed, I determined to devise a geared drive, including reverse, this being useful for withdrawing taps and occasional inverted-tool turning.

When, therefore, fractional horsepower motors could again be obtained, I purchased one, and a friendly word at a car wrecker's yard resulted in the acquisition of a three-speed-and-reverse car gearbox at a very reasonable price. This was stripped and cleaned, and was found to be in very good condition with little perceptible wear at the teeth.

The Treadle Stand

This part consisted of two cast-iron side-frames, of angle section material, with crossbar, and a cast-iron plate bolted across the top. The side frames were originally arranged so that the flat faces were on the outside, and these were changed end for end and refitted to the top plate, the latter being packed up ½ in. at one end to give a fall for future suds pump operation.

The gearbox was then clamped in position by its bell housing to the left-hand side frame, being arranged so that as much as possible of the face lay in contact with the flat faces of the legs and crossbar. The motor was bolted to a piece of 1 in. × 9 in. board, which was clamped across the rear frame legs. After checking for position and alignment, and marking-out, the frame was dismantled and the bolt-holes drilled.

The gearbox, as obtained, was complete with flange for the propeller shaft coupling, secured by the usual spline and nut. The flange was turned down to form a sleeve on which an ordinary 3 in. vee-belt pulley, bored out, could be pressed. The input shaft was splined also, and an aluminium vee-pulley was bored out to fit the outside diameter of this shaft. A socket-head grub-screw seated between the splines locks it quite firmly.

The frame was then reassembled, and the gearbox and motor board bolted to it, wooden packing being interposed between the face of the bell housing and the side frame casting, and also between the motor board and the curved faces of the frame legs to form truly mating surfaces. The gear lever was re-bent to bring it to the front of the stand in a convenient position for handling.

When the motor and gearbox pulleys were lined up, slots were marked and cut in the bell housing, extending from each side of the original clutch inspection opening to allow clearance for the belt. The opening was subsequently covered by a small plate.

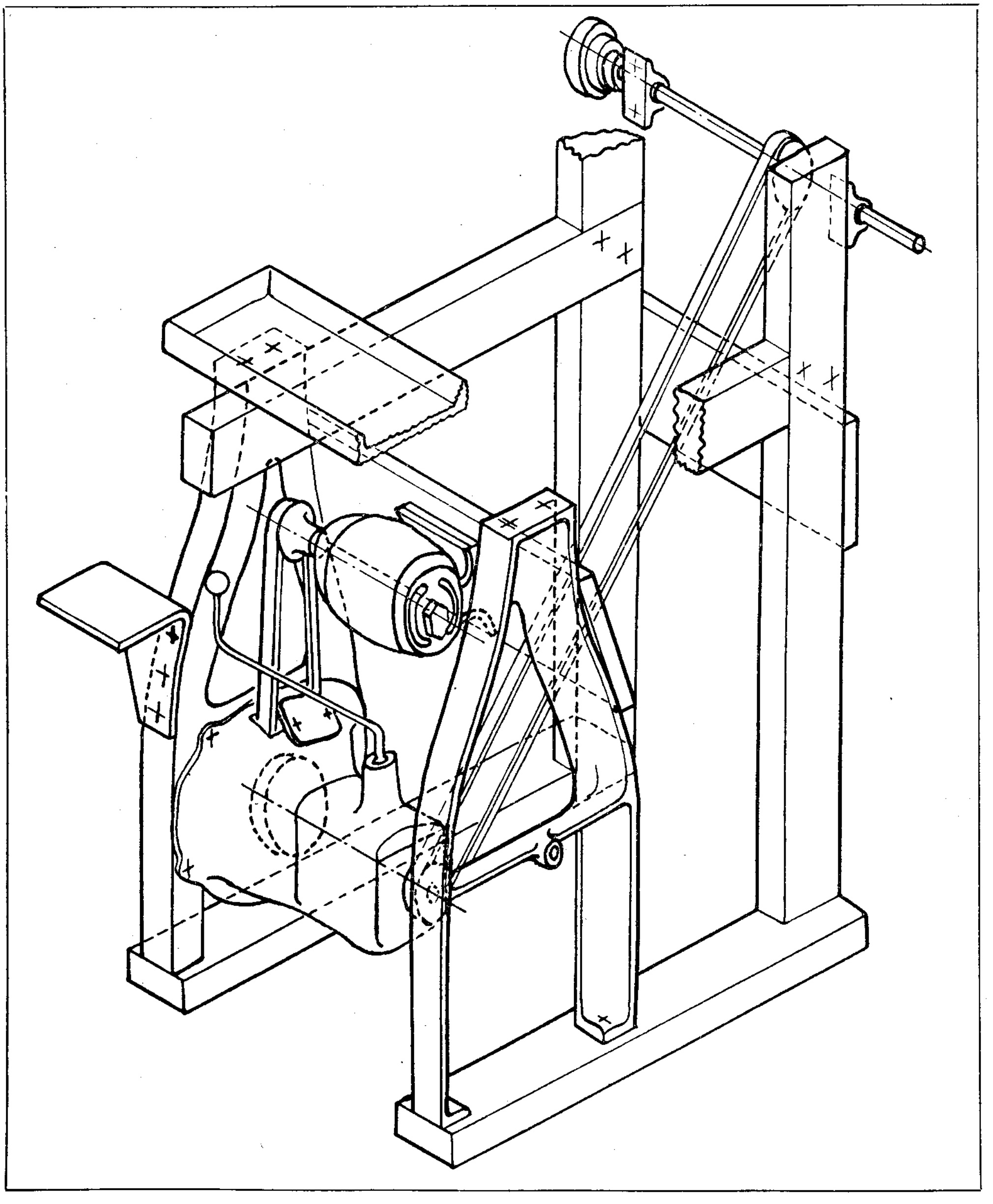
A wooden framework was then constructed from 4 in. × 2 in. timber to carry the countershaft, which runs in die-cast plummer blocks of the type readily obtainable. A 4 in. vee-pulley takes the drive from the gearbox, and a laminated wooden cone was made for the final drive.

The lathe rests on wooden blocks laid on the cast top of the frame, these being shaped to bring the bed level and to allow easy clearance of swarf. The lathe was not finally bolted down until the countershaft could be driven by the motor. The lathe was then temporarily driven by a belt made from a piece of string, and when this showed no tendency to wander across the pulley faces, holes were marked and the lathe bolted down.

Nine Speeds

The combination of three pulley steps and three gearbox ratios gives theoretically nine different speeds on the lathe, or 18 if the back gear is counted as well. It was seen, however, that the second gear ratio was very nearly the same as the step-up or step-down ratio of the cone pulley drive if equal cones were used, so that several of the lathe speeds would be for all practical purposes identical. This was mitigated by the use of odd cones, the countershaft cone having all steps larger than their fellows on the lathe. The countershaft steps were arrived at by trial and error, suggesting a possible diameter for one step finding the corresponding two diameters, and working out the nine ratios. If some speeds came out virtually the same, another trial was made. The corresponding cone diameters were found on the drawing board by the method described in the *Machinery Handbook*. That shown on page 564 of THE MODEL ENGINEER for April 20th, 1950, would also no doubt be suitable. In any case, the final sizes were checked in place by direct measurement with a tape measure stretched to a constant tension, any inaccuracy being turned off the step by a hand tool resting on an angleplate screwed to the wooden upright. The countershaft framing was designed with this in mind.

The motor pulley diameter is 2½ in. and this drives a 7 in. pulley on the gearbox input. The final speeds at the lathe are :



Gear Ratio	Pulley Ratio		
	Low	Middle	High
1st	90	150	245
2nd	175	285	480
Top	315	515	870
Reverse	115	180	315

With back gear engaged, divide all speeds by 9.

It will be seen that the overlapping of the various ratios has not been completely eliminated but this is not a very great disadvantage, for the pulley ratio can be selected to give the most suitable range of speeds for the particular operations in hand, and speed changing can then be done on the gearbox.

A "Picador" double-ended grinding-head was mounted on a piece of $\frac{1}{4}$ in. plate, which was suitably cut and bent, and bolted to the left-hand frame leg. This takes its drive by vee-belt from a short countershaft which runs in a singel die-

cast plummer block mounted on the side frame, the shaft being dead in line with the armature shaft of the motor. The motor main drive pulley has four case-hardened stubs, like cheese-head screws with very deep heads, screwed into it, which engage a dog clutch member secured to the end of the grinder countershaft. A selector fork and lever engage this drive when required.

I have found that a single grinding wheel will do all the grinding work I want, and the other end of the spindle has been fitted with a 4 in. circular saw and table. The comparatively short overhang of the spindle restricts the width of plank that can be ripped, but what can be done is done in a manner that seems miraculous after years of handsawing. Work is now proceeding on a power hacksaw, to be fitted somewhere to the framework, to remove the drudgery from this task, too.

Both the motor, and the whole outfit, are mounted on rubber blocks, and the running noise is comparatively small. The unit is not bolted down to the floor—it shows no tendency to "walk"—and all the joints are bolted so that the outfit can be dismantled and reassembled elsewhere if necessary.

This conversion to geared drive has proved to be well worth while, apart from the pleasure derived from building it. Already several additions and improvements have suggested themselves, notably modification of the grinder shaft to incorporate a high speed countershaft for driving other tools where this is necessary. In fact, once the general arrangement of the framework was decided, it was realised that it could form the basis of a complete power-driven, semi-portable workshop, capable of performing a large variety of operations in both wood and metal.

I trust that the sketch will be found to be self-explanatory—no details or dimensions are included, as these depend to a great extent on individual taste and requirements.

For the Bookshelf

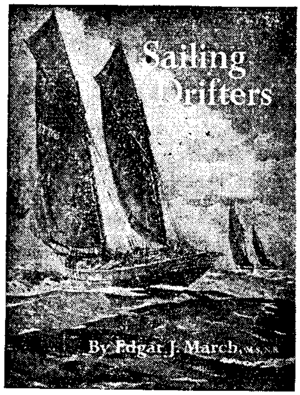
Sailing Drifters, by Edgar J. March. Published by Percival Marshall & Co. Ltd., 23, Great Queen Street, London, W.C.2. Price £3 3s. 382 pages, 9¾ in. × 7¼ in.

This is an outstanding book, and one which we have not the least doubt will become the classical work on the subject. It is the result of years of research, involving much travelling in search of old photographs and old records, and innumerable contacts with individuals who took part in the fishing industry in the days of sail, both by personal visits and by correspondence. This work was done at the best possible period, because first the ships and the life described were sufficiently in the past, so that one could see them in their true perspective, and second, it was done while a few of the people concerned were still with us, and also while the plans of the ships were still available.

The text describes the history of the fishing industry from its early beginnings, the development of the craft employed, and how these varied from one district to another, the types of people engaged in the industry and its ancillary trades, and character sketches and stories showing how the fisher folk lived and worked. It contains also a mass of technical information about the boats and their gear, and of how the boats were built, rigged and operated. Throughout the text there are line drawings, 76 in all, to help clarify the subject. There are 191 superb reproductions of photographs, some taken nearly 100 years ago.

The book covers the entire coast of Britain, beginning at Lowestoft and the East Coast, working round to the Cornish coast, then up to the Isle of Man and around the Scottish coast, completing the circuit with the craft used on the Yorkshire coast.

At the end of the book there are 28 sets of plans of the boats, comprising 60 pages, all accurately drawn to scale, the scale being given in all cases. These include a three-masted Yarmouth lugger of 1848, a two-masted Yarmouth lugger of 1859, the Lowestoft drifter *Strive* of 1898, a Polperro gaffer, pilchard boats, mackerel drivers, Mounts Bay luggers, Manx luggers, nickeys and nobbies, scaffies, Zulus and Fifies from the north and east coasts of Scotland, including luggers, yawls and skiffs. These plans will be of the greatest interest and value to the ship modeller, many of the sets providing all the detail necessary for the construction of an accurate and fully-detailed and fully-rigged model. These are clearly reproduced to as large a scale as possible, many of them crossing two pages. All the line drawings, and most of the plans, are drawn by the author, who is an accomplished draughtsman. The glossary at the end of the book is a valuable feature, as many of the terms used were peculiar to the fishing industry and also peculiar to their own particular locality. The book is beautifully printed and well produced, and is quite up to the high standard this firm has set for its maritime books. The picture on the jacket is well worth preserving as a beautiful and accurate painting of the Lowestoft drifter *Strive*, and in the background is a Scottish lugger with its tall sails. This book will add considerably to the reputation the author made for himself with his book on the spritsail barges. It will be treasured by its purchasers, and the somewhat high price will be forgotten when the book is studied and its value fully appreciated.



MAKING A BALL HANDLE

CLAMPING levers, formed with a ball at either end, are fitted to machine tools to give a quick action without the use of a spanner. The lever fitted to some lathe tailstocks is a familiar example.

In commercial practice, these ball handles and other fittings of this kind are usually machined with a form-tool, shaped to finish the parts to a uniform size by taking a plunging cut directly into the work. For this sort of machining, the lathe must be extremely rigid, and if an attempt is made to do this in a small, light lathe, severe chatter is almost certain to develop.

In the small workshop, therefore, it will usually be found that the easiest way of going to work is to make the handle in two parts, as represented in Fig. 1. The large ball is formed solid with the shank, and the small ball is turned separately and then fitted in place. There are, of course, several ways of carrying out the machining, but the following method has, in practice, been found to give satisfactory results.

To make a well-proportioned handle, the component should first be set out on the drawing board, and it is a good plan to take the dimensions from an existing part and make any modifications needed. When the size of the large ball has been fixed, it is advisable to make a sheet-metal template as an aid to machining the spherical form. For this purpose, a hole of the correct diameter is cut or drilled in the metal sheet, and the surplus material is afterwards cut away. The work is now machined as shown in Fig. 2 and, after forming a chamfer with a lathe tool, the curvature is shaped to fit the template with a hand graver supported on the lathe hand rest, as represented in Fig. 3. The method of using the hand graver was fully described in THE MODEL ENGINEER of April 13th, 1950.

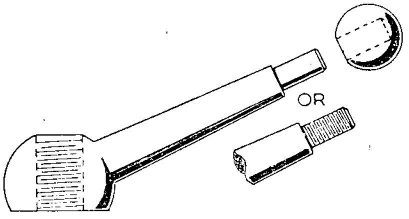


Fig. 1. Showing the two parts of the built-up ball handle

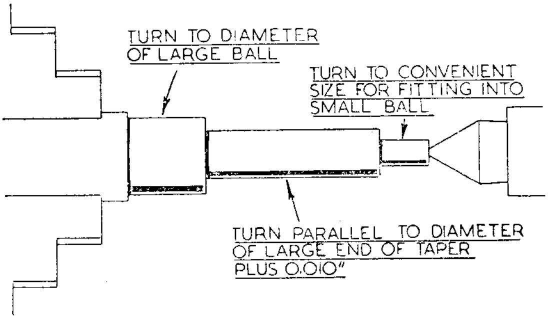


Fig. 2. The preliminary machining operation

After the outer half of the ball has been finished, the bar is parted off to length, and the work is reversed in the four-jaw chuck for finishing the ball in the way shown in Fig. 4; meanwhile, the template is applied from time to time to make sure that the correct curvature is being maintained.

Next, as shown in Fig. 5, the work is again reversed in the chuck and is protected from damage by placing slips of sheet copper under the chuck jaws. The parallel seating for the small ball can now be formed, and the tapered shank

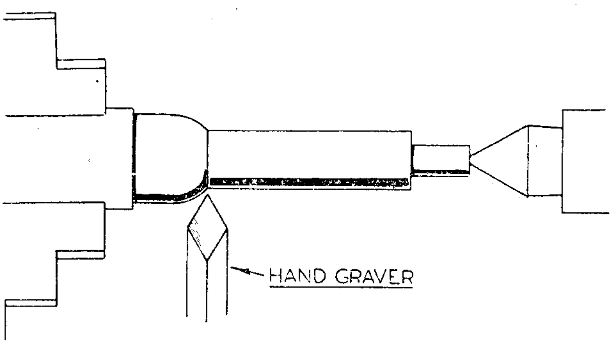


Fig. 3. Forming the outer half of the ball

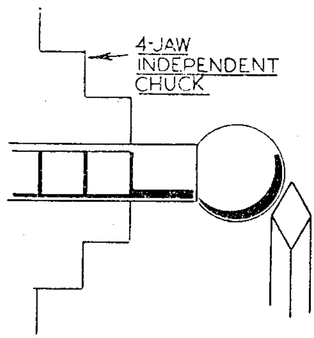


Fig. 4. Finishing the ball with the hand graver

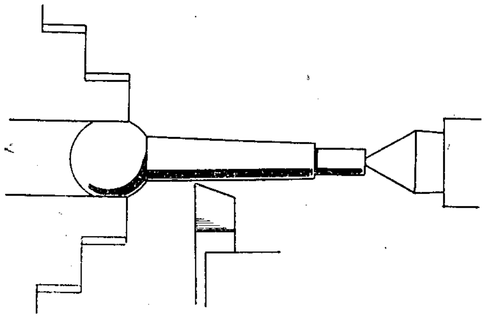


Fig. 5. Machining the tapered shank of the lever

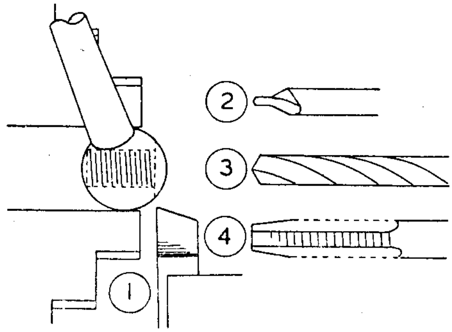


Fig. 6. Machining the abutment face and threading the ball

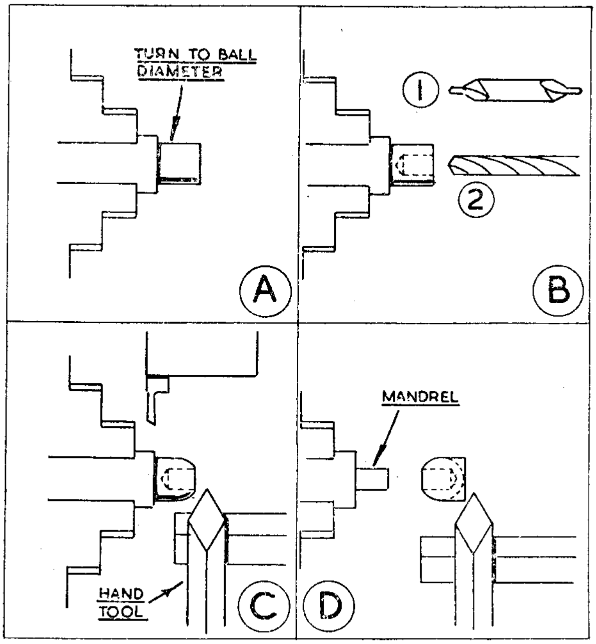
is machined by setting over the lathe topslide to the appropriate angle.

To form the abutment face of the lever in accordance with Fig. 6, the large ball is gripped in the chuck and the shank is set at the required angle ; The face is then machined with a knife tool, and this is followed by drilling and tapping the ball to match the stud on which it screws.

The small ball can either be screwed on the shank or, more easily, it can be made merely a firm press-fit.

The stages in the machining of this ball are represented in Fig. 7 and, again, it is advisable to make use of a template in order to maintain and even curvature.

Finally, the ball is securely seated on the lever shank by being pressed home in the vice, and soft clams are used to protect the finished surfaces of the work.



Right—Fig. 7. Illustrating the stages in machining the small ball

Catalogues Received

Bonds o' Euston Road Ltd. have favoured us with copies of their two new catalogues. Previously, this firm issued a comprehensive "Catalogue and Handbook of Model and Experimental Engineering" ; now the publication is split into two handy and convenient booklets, and we think that the change will be welcomed by most clients.

One booklet consists of 80 pages, and is devoted solely to model parts ; that is, to finished models, finished fittings, castings, etc. ; it is intended primarily for the model trade, and sells at 1s. 9d. The other booklet runs to 56 pages devoted to Bond's famous steam fittings, gears, tools, electric motors and materials, and is essentially of interest to all engaged in the light engineering trades, whether privately or commercially. Its price is 1s. 6d.

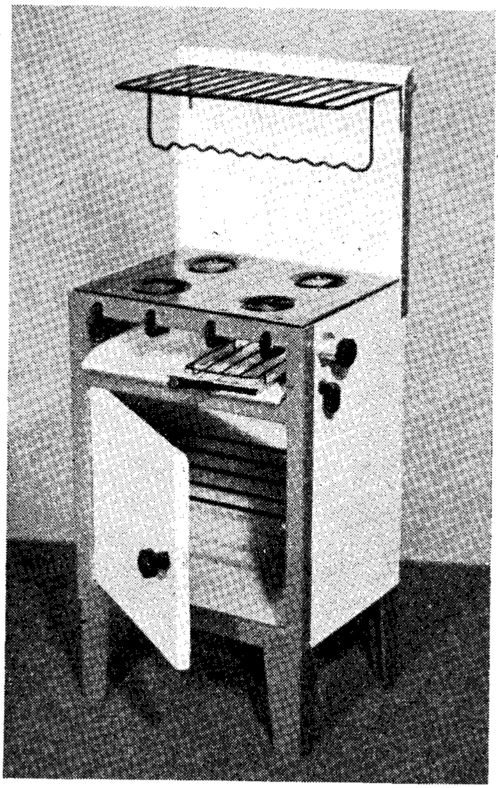
Both are printed on good paper and are well up to the standard of production set by the former handbooks. A perusal of either of these new booklets reveals that a very wide range of products, many of which are of Bond's manufacture, at reasonable prices is available, and we commend these booklets to the attention of our readers.

A Model Gas Cooker

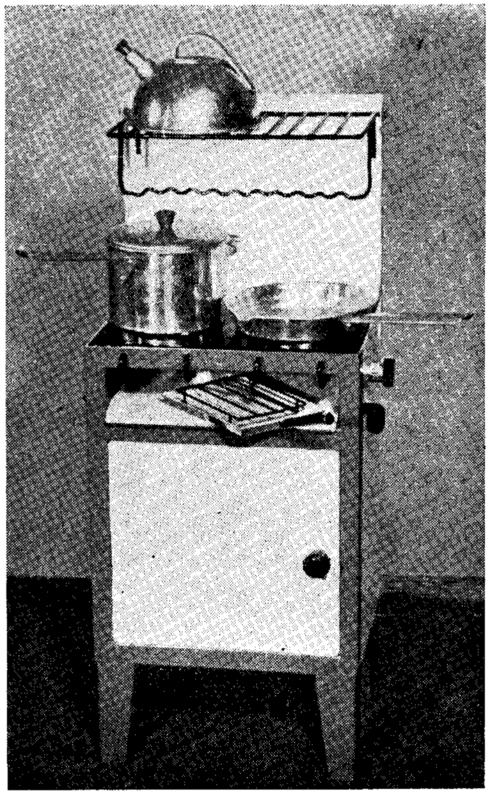
by D. Churm

THIS is not a strict "scale" model of any particular stove, but one that I made for Christmas for our little daughter, and as quite a few people who have seen the child playing "cooking" have been very interested in it, I thought it might be of some interest to fellow-readers of THE MODEL ENGINEER.

It all started just before Christmas, when a relation sent a toy cooking outfit as a present for Junior and my wife thought she would try to get a stove to make it complete. We saw plenty, but all too small for the size of the miniature pans, etc., so I decided to have a go and see what could be done about making one.



Plenty big enough for the rations!



The size of it was decided on by the material at hand, and as regards the design, well, my wife's gas-stove was next door to the "workshop" (corner of the kitchen with $3\frac{1}{2}$ in. lathe and bench vice) so it was only a matter of nipping in and out with a rule for some idea of the various sizes. It is all made of light alloy of 18-gauge, except the grilling pan, which was made out of a thin piece of copper that was handy and just the size; the handle is a piece of copper tube $\frac{1}{4}$ in. dia. with a head turned out of brass and sweated with soft solder, and the grilling rack was made out of $\frac{1}{16}$ in. dia steel wire, brazed together

The stove is just over $17\frac{1}{2}$ in. high from bottom of legs to the top of the plate rack, 7 in. wide across the front, and $5\frac{1}{2}$ in. deep.

The front was made first, the holes being cut out for door and grill, and then flanges turned up round the door frame and grill aperture, also the edges were turned for the sides to fit under; next, the back and sides were made in one piece, then the top was made with a flange round all four edges, fitted in and screwed in position. Then the oven top was put in, followed by the bottom with the four legs which were riveted on. It was by now beginning to look something like a gas-stove. Next, the door was made and fitted with a plastic knob, and finally, the tray which slides under the griller and the back was put on, with the plate rack, which was made out of $\frac{1}{8}$ in. dia. steel and brazed together; it folds up

"just like Mummy's," as our little girl says.

The holes for the "burners" in the top were punched out and radiused, and some pieces were arranged underneath to look something like a burner, also the holes did not look so bare. The taps are made out of some pieces of Paxolin, and work by pushing over from side to side.

The "Regulo" consists of a piece of dural, turned in the shape of a flanged bush, and the aperture for the figures was filed out; next, a plastic knob was used for the other half of it, then it was turned down on the neck part till it fitted freely in the body, and drilled and tapped 2 B.A. for the retaining-screw to keep in its housing. It was divided into four parts, and the numbers scratched in with a scriber, and then some Indian ink was put in the figures to make them stand out clearly against the white of the plastic. When the "Regulo" is turned, the figures appear one at a time in the aperture; below the Regulo is the oven tap, which also moves round.

After this came the painting. Green, white and black for the top part where the pans, etc., are put; the inside of the oven was painted blue, and also the shelf and plate rack were painted black. All this took me about two weeks, mostly in the evening; work at the week-end had, of course, to be done very secretly, because, as I said, the "workshop" is a corner of the kitchen, and, as usual, when I am doing something, a little voice will pipe up "What's that Daddy?"

PRACTICAL LETTERS

Ball-bearings in Clocks

DEAR SIR,—It was with some considerable amazement that I read your reply to Query No. 9970 in a recent issue of THE MODEL ENGINEER.

I have good reason to believe that I am the only person in this country qualified to give the correct answer to the enquirer, being the builder of the only turret clock in existence which is fitted with ball-races throughout (even to the rocker shafts of the gravity escapement, which was designed by myself to replace existing anchor escapement). I can only assume that the answer you gave was supplied to you by some dyed-in-the-wool clockmaker of the old school who are bitterly opposed to the incorporation of such modern innovations in clocks.

From the purely technical angle, the intermittent movement of a clock train, which requires, above all things, a very rapid acceleration from rest at regular intervals, demands a bearing with as little drag as possible, and no matter how fine a workman a horologist may be, he just cannot produce any sort of plain bearing with as little drag as that of a first-class ball-race. To give conclusive evidence of this, you will be interested to know that the clock that I fitted with ball-races (Sunny Bar—Doncaster) in its original state with plain bearings (or pivots) in good condition, required a pull at the drum of 16 lb. to produce acceleration necessary to actuate an anchor escapement, but when fitted with ball-races of the standard light-weight pattern required a pull of only 2 lb. 5 oz. at the drum to produce acceleration necessary to actuate the *gravity* escapement. This enormous reduction in driving pull will obviously lead to far less wear than would be the case with the load necessary when plain bearings are fitted.

The contention that the intermittent motion of the ball-races will result in a series of indentations is too fantastic to face up to the slightest amount of investigation, and is analogous to the argument that because human beings propel themselves by a series of intermittent pressure of their feet along the ground that in time the pathway along which people regularly walk will become a series of deep pits at regular intervals. The movement of the balls in the races is so slight at each impulse of the clock, and it being highly improbable that this amount of movement will be exactly divisible into the circumference of the race, and also that the load on the race is so slight relative to the normal load of such a race that it is sheer fantasy to even give the possibility of indentation a second thought. Basing my estimations on the normal loading of the normal race used, and the length of life of a race under these conditions, I have arrived at the fact that no form of wear whatsoever will be apparent on any but the smaller races until the clock in question has been running continuously for about 150 years, in which time none of us will be interested, and in any case it is most likely that the races will be more affected by corrosion than mechanical wear.

The gravity escapement, which was designed especially for this clock, works on a cam and roller principle and requires far less power to operate it, and has none of the disadvantages inherent in the Grimthorpe escapement, so beloved of our turret clock makers (though nevertheless a mechanical monstrosity).

If "J.B. (Witney)" will write to me, I shall be only too pleased to supply him with all the information he will require to carry out a successful conversion.

Yours sincerely,
Doncaster. J. A. SAUNT, C.M.B.H.I.

Traction Engines in Sussex

DEAR SIR,—I was very interested in Mr. D. Greenwood's letter published on September 11th. Since then, I have conducted weekend hunts around the same area and think that readers may be interested in the following notes.

The engine at Shoreham is a Fowler, 2-speed, 4-shaft, compound Showman's engine, No. 9456, Reg. No. KK 3634. It is owned by T. Smith and Sons Amusement Caterers, Shoreham-by-Sea. It was last used three years ago and is to be done up again for its original job!! They also own the Savage Centre Engine mentioned by Mr. Greenwood, which is working at Fishergate Fair not far away.

A mile on the Brighton side of Henfield is Tasker Compound Class "C" spring-mounted

road locomotive engine, number unknown, Reg. No. AP 9027; owners, Frank Duke, builders and contractors, Steyning. This engine is being used to assist in felling trees; it was previously owned by T. Smith and Sons, already mentioned, who sold it to Brighton Corporation Waterworks around 1940. It was to be used in hauling drinking water about the town should the water mains be bombed or become contaminated.

In Greystone Quarry, now a scrap yard dump, are the remains of a 6-n.h.p. Allchin. Its Reg. No. is PN 4338.

Behind the church at Falmer can be found a 7-n.h.p. Burrell 3-speed compound No. 3777, Reg. No. Y9922; owner, Leonard Page, also of Falmer. This engine was last used in 1948 for hauling wood.

My friend, Mr. M. V. Pink, also mad on tractors, owns a Clayton and Shuttleworth, No. 36336, 7-n.h.p. single-cylinder, 4-shaft, Reg. No. BP 5821. This is stored for him at Church Farm, Fletching and I'm sure a letter to this address would not go unanswered. This engine is in finer finish than I have ever seen elsewhere.

In a woodyard close to Glynde Railway Station is to be seen, Allchin No. 1546, single-cylinder, Reg. No. A.P. 9079, 7-n.h.p., owned by C. Hobden of Ringmer, a real "engine" man.

To conclude, Mr. H. Hobden has a Wallis expansion and Allchin at Isfield, Mr. W. Hobden has a 7-n.h.p. Marshall at Spithurst, near Barcombe, Mr. West has a Ransomes No. 39127 at Burgess Hill and there is a Fowell, No. 98, at Midhurst, a Foster at Kingsley Green, and a Burrell at Iping. I have just heard of a newcomer, possibly for sale, at Lindfield.

The above will show what I have been trying to prove, that there are more engines in Sussex than most places, not forgetting the fine Marshall compound stationary horizontal engine, No. 41432, built 1905, used for students to produce indicator diagrams on in Brighton Technical College.

Yours faithfully,
Brighton. M. L. FINCH.

Supersonic!

DEAR SIR,—I thought it possible that the following incident which occurred at the "M.E." Exhibition might amuse you. I was at the start of the race car track, admiring the model pits, etc., and wondering why there was no activity. I mentioned this to my wife, when a small voice piped up to give me the reason—"They've broken the 'sound barrier' but they're mending it and the cars will be running again soon."

When I reached the other end of the track I saw what had really happened.

Unfortunately for us it was not possible to repair the "sound" barrier before we had to leave.

Yours faithfully,
Ilford. H. MCLAUGHLIN.

CLUB ANNOUNCEMENTS

South London Model Engineering Society

On Wednesday, December 3rd, at 7.30 p.m., at the "White Horse" Hotel, Brixton Hill, S.W.2, the power boat section are holding their annual boat night. The main topic of the evening will be "Radio-controlled Power Boats." It is hoped to have a short talk by a well-known model engineer on his large radio-controlled boat. This will be followed by a break for refreshments, after which a discussion will be started on suitable rules for radio-control competitions.

At this meeting there will be members of the Thames Motor Cruising Club, who, earlier this year, entertained several of our members at their annual regatta, when we gave a display of model hydroplane racing on the Thames at Hampton Court. Power boat fans, interested in radio-control, are welcome to this meeting and their views on the various questions to be discussed will be welcome.

Hon. Secretary: W. R. COOK, 103, Engleheart Road, Catford, S.E.6.

Stephenson Locomotive Society

The library and meeting room at the society's headquarters, 32, Russell Road, Kensington, London, W.14 are open to members during the evening on frequent dates for informal gatherings, borrowing or consulting books, locomotive lists, etc.

By courtesy of British Railways, party visits have recently been arranged by the various areas and centres to the locomotive works at Brighton, Crewe, Derby, Doncaster, Gorton and Swindon; to the sheds or motive power depots at Willesden, Old Oak Common, Kings Cross, Stratford, Devons Road, Plaistow, Doncaster, Swindon, Blyth, Blaydon, and elsewhere.

Announced indoor events for November included illustrated talks: at headquarters by Mr. P. M. Kalla-Bishop on "Franco-Crosti Locomotives," including a description of the novel boiler intended to be employed in ten of the new B.R. 2-10-0 freight engines; at Birmingham by Mr. C. R. Clinker entitled "A Railway Miscellany, 1852-1952"; at the Manchester Centre by Mr. B. Baxter who was speaking about "Early Railways in North Staffordshire"; at Glasgow where the lecturer was to be Mr. G. Kirkland describing the preparation of timetables. Edinburgh events have included a dinner and social gathering following one of Mr. David L. Smith's popular talks entitled "Days and Ways on the old Sou' West"; Mr. R. I. Nelson's "Footplate Survey of the New Standard Locomotives" as well as a display of French Railways' sound films which were also shown at the Glasgow meeting next day. Mr. I. R. Davidson's subject for North-Eastern Area members at Newcastle was "Irish Railways."

Hull and District Society of Model and Experimental Engineers

The programme of the above society for the 1952-1953 winter session is as follows:—

November 20th. Bits and Pieces.
December 4th. One minute, please.
December 18th. Mr. A. King. (Gears.)
January 1st, 1953. Mr. Daly. (Miniature Locomotives.)
January 29th. Surprise night.
February 12th. Mr. Guy Wilson.
February 26th. Mr. Ted Moore.
March 12th. Film show. (By Aims of Industry.)
March 26th. Mr. Bielby.
April 9th. Mr. S. Tennison. (Electric Traction.)

The meetings are held at 7.45 p.m., at The Trades and Labour Club, Beverley Road, Hull.

Edinburgh Society of Model Engineers

Through the courtesy of British Railways a film show was given on Friday evening, October 24th, to a combined meeting of The Edinburgh Society of Model Engineers and The Edinburgh and District Miniature Railway Club, over 60 members being in the audience. This is the first of an attractive programme, in which many meetings are combined, and prospective members of both clubs are asked to contact the hon. secretary, who will deal with any applications.

The club, at 1A, Ramsay Lane, Castle Hill, Edinburgh, is open on Tuesday evenings from 7 p.m. and Saturday afternoons from 3 p.m.

Hon. Secretary: JAMES H. FARR, Wardie Garage, Ferry Road, West, Edinburgh, 5. Tel. No. 84176.